Factory

Management and Maintenance

The Union of Tomorrow

Cases in union cooperation with management which indicate how organized labor can secure the confidence of management and contribute toward economic progress

Sweden's Labor Contracts • **How Much Electric Heat?**

Personnel Records of Today **Phone Systems Within the Plant**

141.488

McGRAW-HILL PUBLISHING COMPANY, INC.

HERE'S WHY
CONVEYOR MAKER
SELECTED SUPERLA
• IT IS NOT a coincidence that roll bearings on the belt conveyors shipped by a large midwestern manufacturer are protected by Superla Grease. Only after fact-finding study and competitive tests was Superla given this responsibility.
Two distinct qualities in Superla make it an ideal lubricant for this service. Superla does not separate, even after extended periods of service. The higher viscosity oils used in Superla provide better lubrication, even in the lighter grades.
Other qualities make Superla the most economical grease for *many* jobs. Its stubborn resistance to water recommends Superla for pump lubrication and similar wet operating conditions. Superla X grades were particularly designed for high temperature bearing lubrication.
Pick out your troublesome grease lubricating jobs. Let a Standard Lubrication Engineer specify the correct grade of Superla for them. High consumption, overheated bearings and leakage are some of the problems Standard Engineers and Superla Grease have solved for others.
You'll find a Lubrication Engineer at your nearest local Standard Oil office. Call him or write 910 South Michigan Avenue, Chicago, Illinois. Remember, his helpful service will cost you nothing.
Copr. 1938, Standard Oil Co.
SUPERLA
GREASE
STANDARD OIL COMPANY (INDIANA)
LUBRICATION ENGINEERING
THE RIGHT LUBRICANT • PROPERLY APPLIED
TO REDUCE COSTS

"Now they're making hose of coke, limestone and sea water"

A typical example of Goodrich development in Rubber

HOSE is one of the latest things to be made with materials taken out of the sea and the ground. For years hose for gasoline pumps had to be specially made—with metal inside, heavy fabric outside—because gasoline dissolves the rubber of ordinary hose. But this metal-and-fabric hose was bulky and stiff, especially in freezing weather, and had to be replaced frequently.

Then Goodrich developed new synthetic elastic compounds and established a special "synthetics department," to apply them to rubber products of all kinds.

One of those products is a light, flexible, easy-handling, fast-flow gasoline hose that station attendants all like and that saves money for the service station owners.

It's an illustration of the Goodrich attitude toward all new things. Rubber products must change and improve just as mechanical products do —and Goodrich adopts that "spirit of change" toward belting, hose, rolls, and all other industrial rubber products no matter how commonplace they may seem. It's the reason you save time and money when you specify *Goodrich* to your distributor. The B. F. Goodrich Company, Mechanical Rubber Goods Division, Akron, Ohio.

Goodrich

ALL *products problems* IN RUBBER

Another story of Goodrich development work appears on the page facing the third cover

FACTORY MANAGEMENT and MAINTENANCE (a consolidation of Factory and Industrial Management (including "Factory") and Maintenance Engineering), Sept., 1938. Vol. 96; No. 9. Published monthly. McGraw-Hill Publishing Company, Inc. Publication office, 99-129 North Broadway, Albany, N. Y. Editorial and executive offices, 330 West 42d Street, New York, N. Y. Entered as second class matter, November, 1936, at Post Office, Albany, N. Y., under the Act of March 3, 1879. Price 35c a copy. Subscription rates—United States, Canada, Mexico, and Central and South American countries, $3 a year. All other countries, $4 a year or 16 shillings.

Time and cost of wiring connections required for tapping instruments into a circuit can be eliminated! Only three simple steps are required to give you *instant* access to valuable operating facts about *any* electrical circuit:

One: Install Type "S" Sockets
Quickly installed in the conduit — no special mounting, no expensive accessories.

Two: Use Westinghouse Socket Instruments
There is a complete line of low-cost, accurate instruments to fit Type "S" Sockets. Also a test jack for bringing plug-in convenience to conventional recorders, analyzers and portable instruments.

Three: Just Plug In — Any Time
To obtain complete operating facts, simply plug in voltmeters, ammeters, watt or watthour meters or test jack. No wiring connections, no stopping production. Sockets easily sealed off when not in use, or instruments may be left in place.

Westinghouse Sockets make it both convenient and profitable to adopt a planned maintenance program with socket instruments. Send today for complete information about this new, low-cost way to correct low power factor, overloaded or underloaded motors, electrical leaks, faulty process control, excessive machine friction and similar preventable profit leaks. Westinghouse Electric & Mfg. Co., Dept. 7N, East Pittsburgh, Pa.

Send for Booklet B-2136 "Socket Instruments"— explaining how to eliminate troublesome, time-consuming wiring connections when using instruments.

J-40144

SINCE 1888
METERS INSTRUMENTS RELAYS

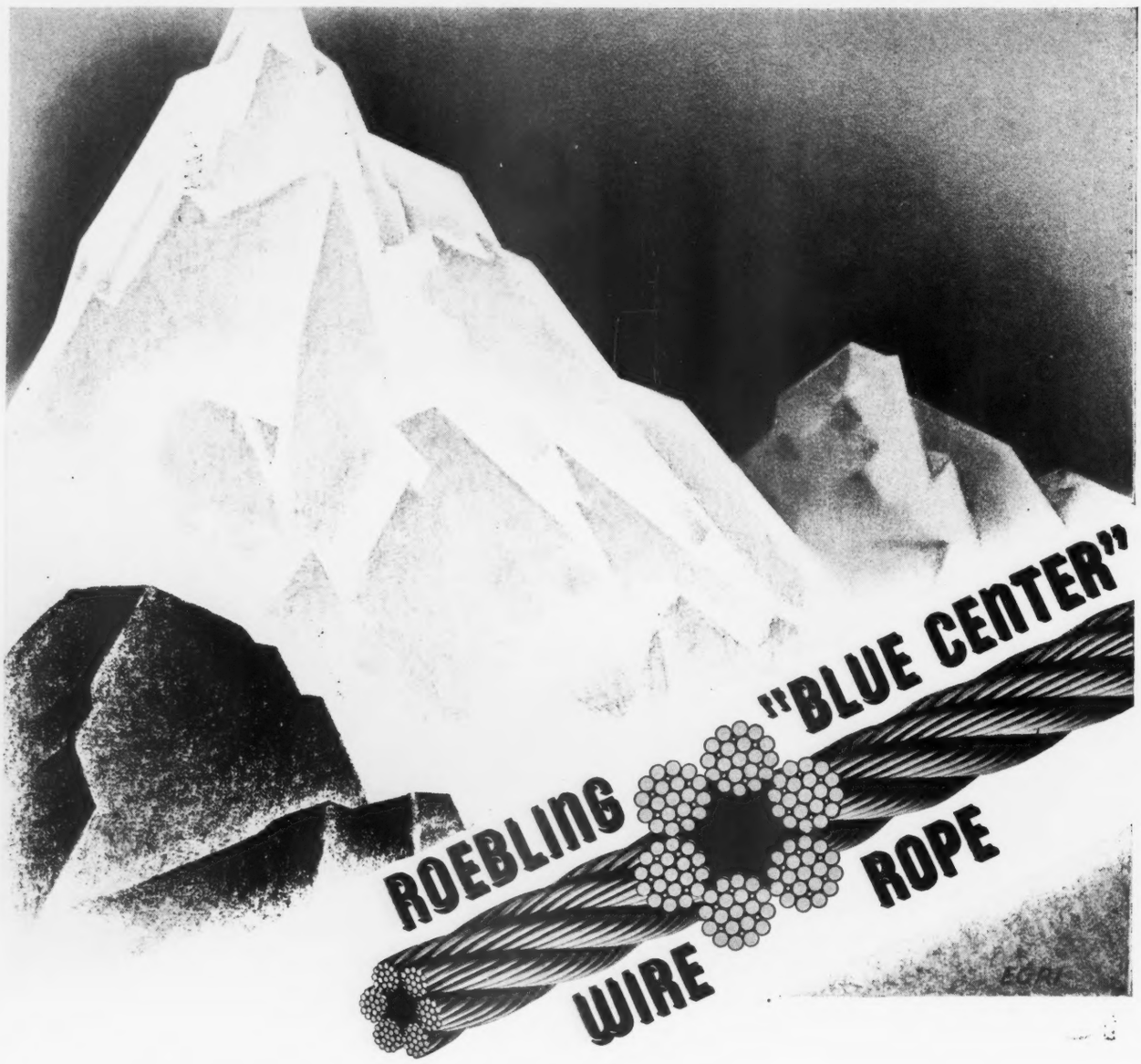
Westinghouse
ELECTRICAL INSTRUMENTS
"The Standard of Accuracy Since 1888"

SHEPARD NILES LiftAbout 2-Ton Capacity Hoist operated on a single I-beam Shepard Niles Crane. Hyatt Roller Bearings, giving many extra years of attention-free service, are standard equipment in the LiftAbout.

Evidence of Hyatt reliability is found everywhere. In service on wheels, on shafts, and gears, Hyatt Roller Bearings are sturdy, smooth and quiet . . . faultless in design and workmanship, carefree in operation. The millions of Hyatts applied each year to new equipment roll on unheeded, except by the engineers, who have learned to specify and depend on Hyatt Roller Bearings. Hyatt Bearings Div., General Motors Corp., Harrison, N. J.; San Francisco. Hyatt Roller Bearing Sales Company, Chicago and Pittsburgh.

HYATT *Roller* BEARINGS

FOR PEAK ROPE PERFORMANCE!



For maximum rope life... for maximum rope safety... use Roebling "Blue Center". The finest wire rope that Roebling produces!

JOHN A. ROEBLING'S SONS CO., TRENTON, N. J.
BRANCHES IN PRINCIPAL CITIES

STRONGER—Wire of highest strength consistent with ductility and toughness

TOUGHER—Provides maximum resistance against wear, sudden shocks, vibration

SAFER—Unequalled for uniformity of quality

SAVING—Insures lowest general average operating cost

THE HIGHEST DEVELOPMENT IN ROEBLING WIRE ROPE

HE'D like to point out what the word "obsolete" is meaning to you in dollars and cents. How a more modern application of power... up-to-date wiring layouts... can bring the greater efficiency that means profits in these days of rising costs. How better lighting and ventilation increase production per man . . . improve workmanship.

We have something to say, too. Modernization . . . re-building... need not appear as an over-imposing task. Graybar's 60,000 item Service of Supplies simplifies purchasing... provides a source of everything electrical for every factory need. Graybar specialists can help you with experienced advice on specific lines. And a nearby Graybar warehouse makes these products promptly available... when and where you need them. **OFFICES IN 85 PRINCIPAL CITIES. EXECUTIVE OFFICES: GRAYBAR BUILDING, N. Y.**

$3656.42 SAVED IN ONE YEAR by Fuseless Circuit Protection

Automatically protects circuits against severe overloads and "shorts" — without time lost by men and machines and costly fuse replacements.

Safety for circuits
Safety for workmen
Safety for machines

and SAVES many times its cost.

An accurate cost and time study record in a medium sized Eastern plant shows that Westinghouse "De-ion" Nofuze Circuit Breakers save $3,656.42 in one year. Fuseless circuit protection adds this extra profit by reducing lost man hours, by cutting down lost machine hours, and in lower maintenance costs.

Perhaps there are extra profits in your plant that may be uncovered by investigating fuseless circuit protection. Why not look into it today? Call your nearest:

Electrical Wholesaler — Electrical Contractor
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WESTINGHOUSE ELEC. & MFG. COMPANY
EAST PITTSBURGH, PA.

J-20528

Westinghouse *Nofuze "De-ion"* CIRCUIT BREAKERS

MOTORS • LINESTARTERS • CIRCUIT-BREAKERS • SAFETY SWITCHES • PUSH-BUTTONS

20,000 Customers
BUILT THIS TOOL FOR YOU

The money-saving and time-saving experience of over 20,000 customers has been important in the development of the Acme Steelstrap system. The new No. 2 Steelstrapper combines stretching, sealing and cutting operations with an automatic seal feed. It is the latest addition to a complete line of tools designed for the sole purpose of helping shippers to economically apply Steelstrap and make shipments "Bound to Get There." One or more of these Steelstrap tools will exactly meet your requirements and provide maximum economy.

Acme Steelstrap is sold *only* by Acme sales engineers. They are competent and fully qualified to make practical suggestions for safer, more economical packings of any type of product shipped in any kind of wrappings and containers.

Doc Steelstrap has had over 55 years of experience in helping manufacturers reduce their packing and shipping costs. He will be glad to tell you the amount which *you* can save by using Acme Steelstrap. Write for complete data, today. There is no obligation.

ACME STEEL COMPANY
2831 ARCHER AVENUE, CHICAGO, ILLINOIS
BRANCHES IN PRINCIPAL CITIES

We'll add 1 *or* 2% *to that*

or you get your money back

"Nobody's ever sold leather belting like this before, but here goes. We're so certain that the new Research Belting will increase average machine production at least 1 or 2% over ordinary belting that we'll give you your money back if it doesn't.

"But it will. It has, on all types of drives. 25% cost saving on a drilling machine. 30% time saving on a grinder. $2.88 extra profit a year on each loom. 15 feet more an hour on spinning frames. More air from air compressors.

"Figure it out. With Research Belting on all your drives—even at only 1 or 2% increase—you'd make a pretty profit!"

YOU can figure it out on your machines, too. Sometimes it runs to thousands of dollars a year. And it's all because completely new manufacturing processes give Research Belting a higher transmission capacity that increases average machine production.

Take advantage of our "money-back" guarantee—you will find the nearest Graton & Knight sales office or distributor in our insert in the belting section of Thomas' Register. Why not call today to get Research Belting on one of your important drives where increased production can be measured?

MODERN GROUP-DRIVE

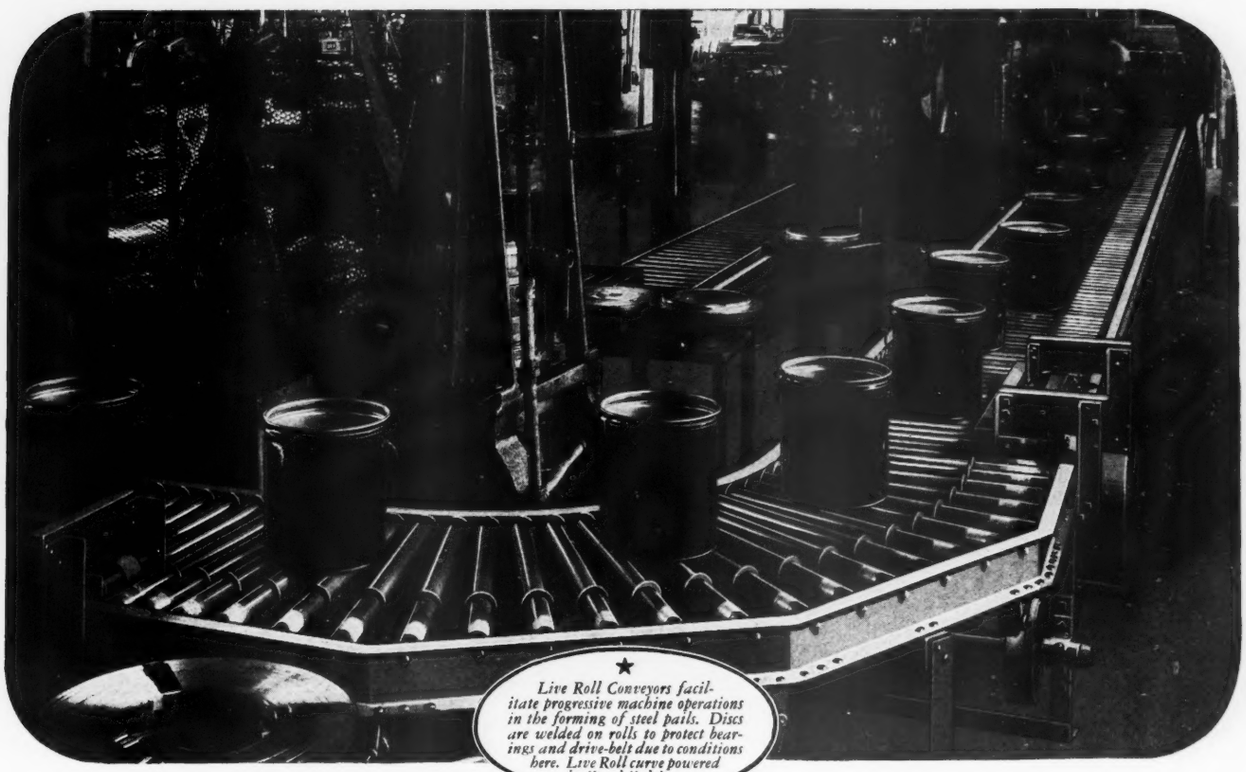
Graton and Knight

RESEARCH BELTING

from the Home of Research, Worcester, Mass.

WRITE FOR OUR HANDBOOK ON LEATHER BELTING AND POWER TRANSMISSION

TODAY'S *low inventories* ARE TOMORROW'S *orders-in-the-making!*



★ *Live Roll Conveyors facilitate progressive machine operations in the forming of steel pails. Discs are welded on rolls to protect bearings and drive-belt due to conditions here. Live Roll curve powered by "mule" drives.*

This Logan user is ready to go!

HE'S READY for returning sales volume—ready to produce profitably—in spite of recent "unnatural" rises in certain costs and insistent demands for low price levels. ***He has acted to meet the situation*** through the installation of intelligently planned conveying equipment, and through other economies.

Foremost among cost reduction plans these days is a careful scrutiny of the material handling problem. Many manufacturers who hitherto have not felt the need for going deeply into this subject, have found opportunities for savings of 20% to 50% and frequently more.

It will pay any plant that's interested in economy, to study every possibility for ***putting flow into production*** via conveyors. Correctly engineered Logan equipment eliminates waste motion, makes every movement of men and machines *a productive movement.*

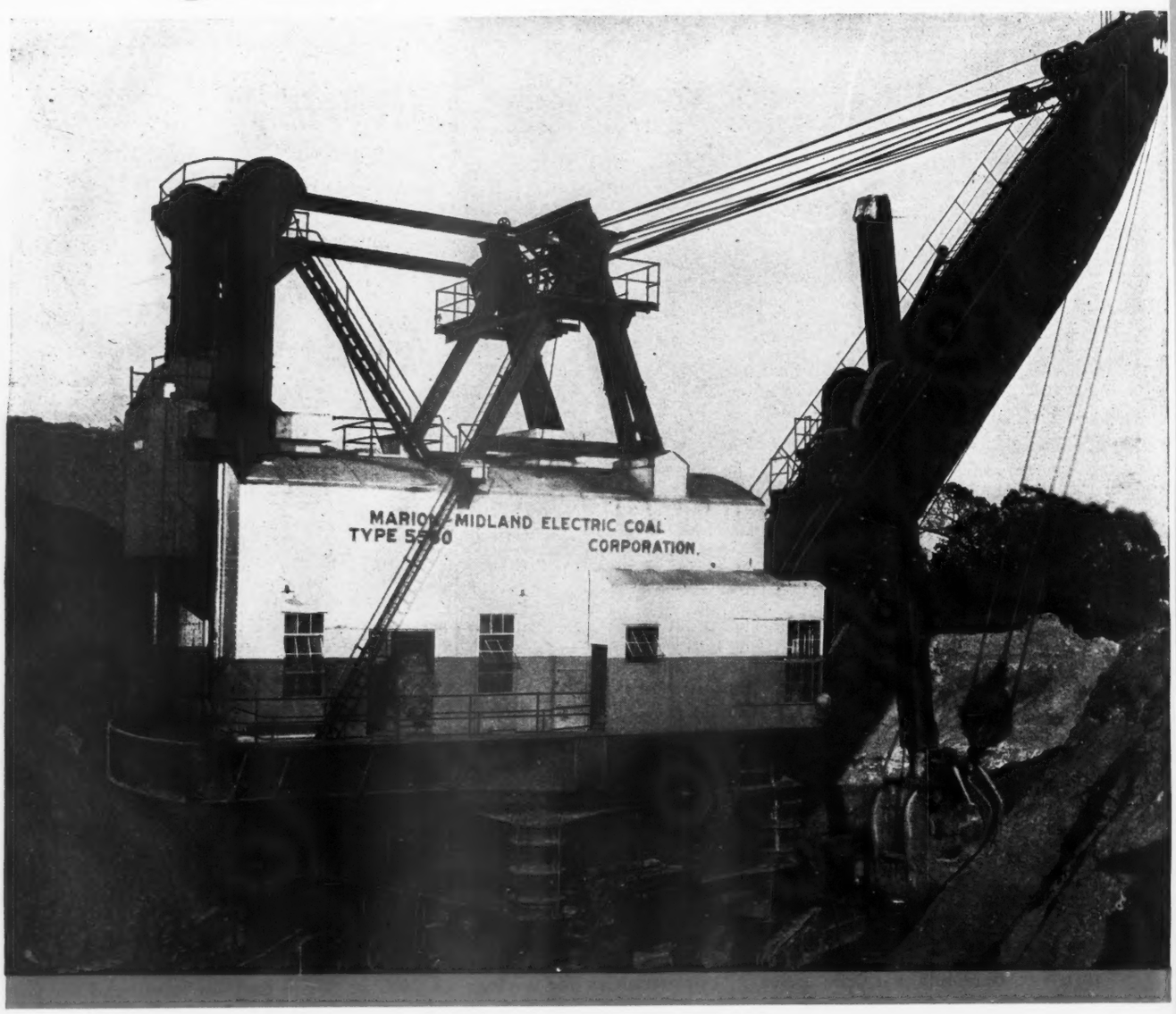
A new catalog on this subject is offered by Logan. In its pages are over 130 illustrations of conveyors in almost every type of industry. Write on your letterhead for your free copy (Catalog 35). Or request a call from the nearest Logan engineer. LOGAN CO., Incorporated, 510 Buchanan St., Louisville, Ky.

MOVING IS 90% OF MAKING

Logan Conveyors

LOUISVILLE

A 27-ton



Built for the Midland Electric Coal Corporation, this Marion shovel originally swung a 20 cu. yd. dipper. In October 1937, the capacity was increased nearly 40% by installing a 27 cu. yd. dipper. This shovel is self-leveling, moves under its own power on a series of crawlers with overall width of nearly 42 ft. A complete plant in itself. Six different Texaco Lubricants are in regular use.

TEXACO
REG. T. M.

TEXACO

Bite... WITH TEXACO

Taking 27 cu. yds. at a "bite," this giant shovel in the Midland Electric Coal Corporation's plant at Middle Grove, Ill., handles an overburden averaging 35 ft. in thickness.

This huge Marion is one of the world's largest strippers . . . 95-ft. boom . . . 60-ft., 3-in. dipper handle . . . powered by 5 motors aggregating 900 h.p.

Since the day it was installed it has been Texaco-lubricated 100%.

On all open gears, Texaco Crater Compound cushions the gear teeth, and protects against abrasive wear. It *clings* to tooth surfaces at high speeds. Resists highest temperatures and pressures . . . and lasts several times longer.

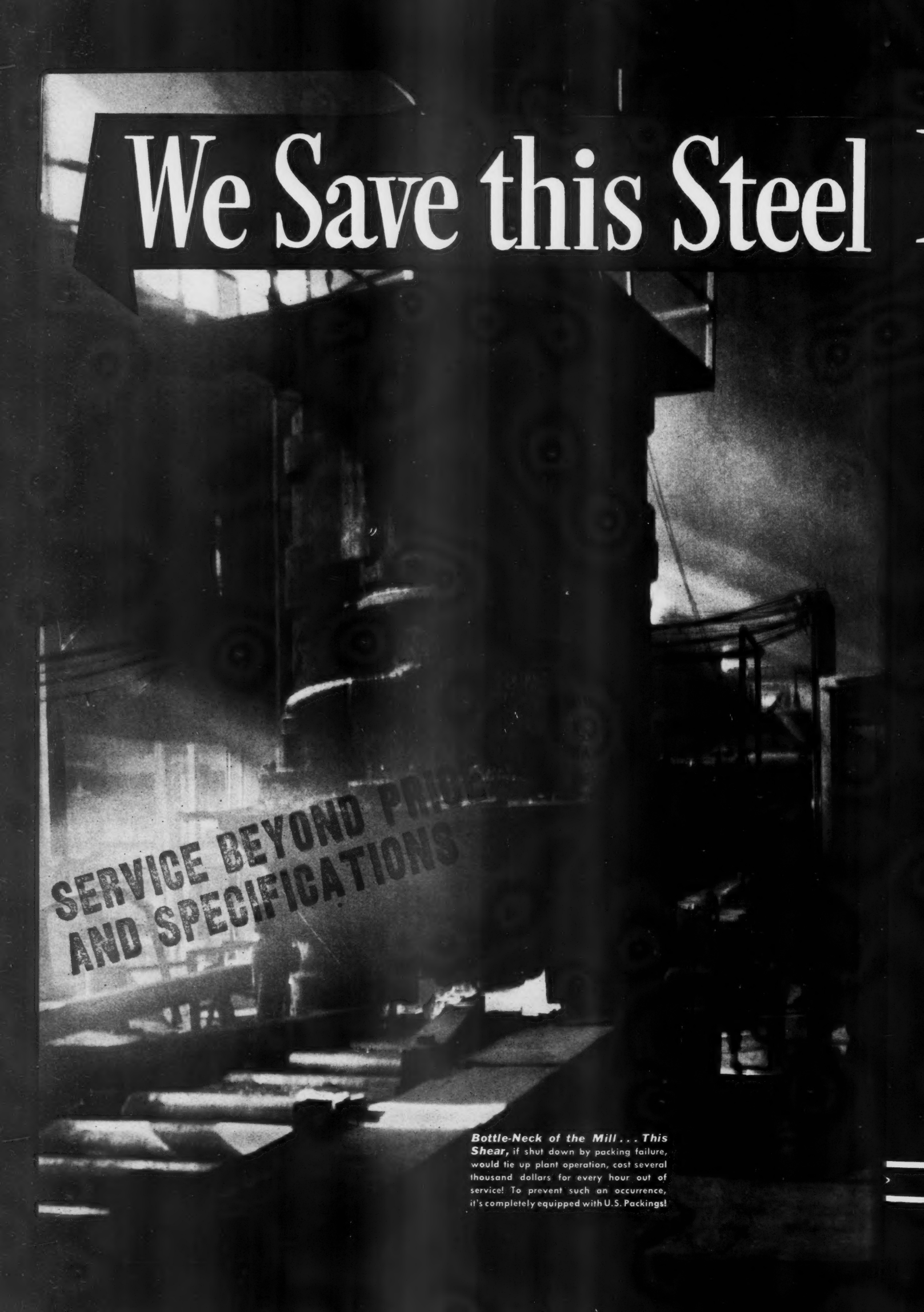
Telephone your local Texaco warehouse for a Texaco representative to call. There are 2108 of these warehouses in the United States, assuring prompt delivery.

The Texas Company, 135 East 42nd Street, New York City.

FREE BOOKLET. *32 pages of money-saving information on the lubrication of gears and wire rope. Shows where to use Texaco Crater Compound, and how. Illustrates simple, easily built rigs for quick application. FREE for the asking.*

Crater COMPOUND

We Save this Steel



Bottle-Neck of the Mill . . . This Shear, if shut down by packing failure, would tie up plant operation, cost several thousand dollars for every hour out of service! To prevent such an occurrence, it's completely equipped with U.S. Packings!

1 Mill $5,000 a Year... IN PACKING COSTS!

THIS PLANT'S ANNUAL PACKING BILL WAS $10,000! STANDARDIZING ON U. S. PACKING CUT COSTS IN HALF... KEPT INVENTORY AT MINIMUM ...GAVE SERVICE BEYOND PRICE AND SPECIFICATIONS! THAT'S WHY IT'S NOW "100% U. S. PACKED"!

Many a mill's packing costs go shooting sky-high . . . while plant engineers and superintendents wonder why! Perhaps *we* can tell you! This plant, for instance, solved its high packing-costs problem . . . cut packing needs in half . . . kept inventory at a minimum . . . through standardization on U. S. Packings. U. S. Packings have given such consistently good performance on the job, wherever used, in addition to the actual savings in dollars and cents, that the entire mill is now 100% U. S. Packed. Whatever *your* packing problem, you'll find we're particularly qualified to solve it for you . . . from an engineering and a cost-saving point of view . . . to give you Service Beyond Price and Specifications!

(Write for "The Preferred Eleven" booklet—featuring the eleven packings that meet most of your requirements. It's NEW—it's FREE!)

UNITED STATES RUBBER COMPANY · US · TRADE MARK ·

United States Rubber Company

United States Rubber Products, Inc., New York, N. Y.

WHY THE ROTOCURE PROCESS OF PRODUCES

THE BWH Rotocure Process of Continuous Vulcanization is the only practical method of producing uniform rubber belting entirely free from press overlaps. It solves the problem because the belting is processed on an exclusive patented rotary type of press, radical in principle. It substitutes uniformity for variation by making the vulcanizing process automatic instead of spasmodic. Uniformity results not from the skill or experience of the operator, but from the unvarying precision of the machine. The result: a uniform belt uniformly vulcanized and uniformly stretched, that will give uniform service.

The advantages of continuously vulcanized belts and the economy which they represent in the operation of your plant cost you nothing. BWH belts, made by this process, are competitive in price. You pay no premium for this extra measure of quality and service. It is only necessary to order belting by name and specify the BWH brand which best suits your service requirements.

BOSTON WOVEN HOSE AND RUBBER COMPANY TRADE MARK

BOSTON WOVEN HOSE

CONTINUOUS VULCANIZATION

BETTER BELTS

BULL DOG

For the severest requirements of drive and endurance. Extreme and uniform flexibility to meet difficult driving conditions. The gold standard of belt value. No drive too hard. No service too severe.

WARRIOR

Built of special 32-oz. duck, folded construction, highly resistant to stress and strain, and with high quality friction between the plies. For hard general use where sturdy and consistent performance is required.

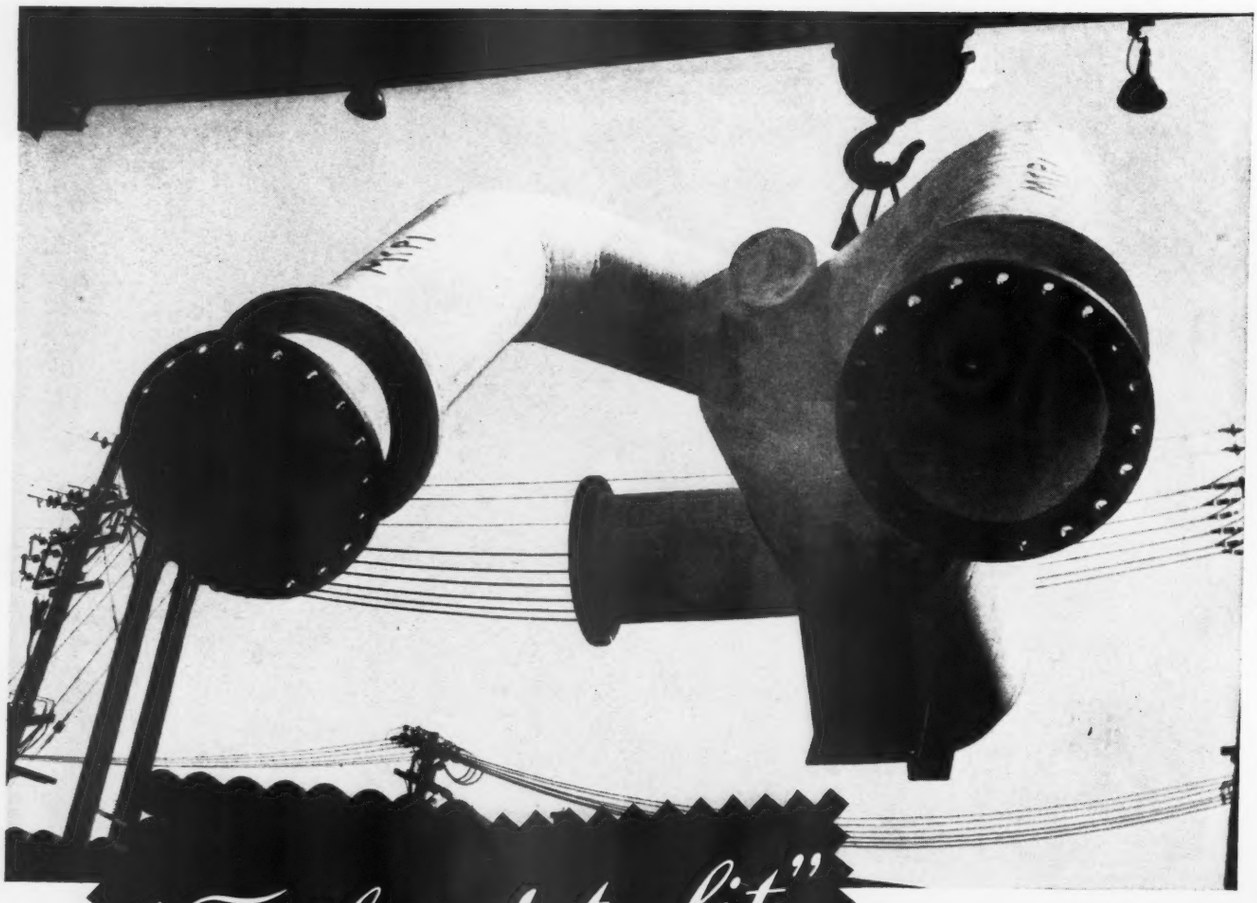
PERFECTION

Built on a proved principle — many plies of relatively light-weight duck instead of a few plies of heavy duck. Widely used in the lumber industry on woodworking machinery; also for motor fan and centrifugal pump drives.

The above belts are made in all standard widths and any number of plies to meet specified conditions. Made endless if desired.

& RUBBER COMPANY CAMBRIDGE MASS. U.S.A.

wanted A SPECIAL CONNECTION



"Tailored to fit"

SPECIFICATIONS
Y Outlets.....20" I. D.
Main Outlet....36" I. D.
T Outlet.....24" I. D.
Thickness .....⅜-inch
Bitumastic Coated and Lined

Here is a typical example of how you can save time and money with Armco Spiral Welded Pipe. "Tailored" to accurate specifications in Armco's modern pipe shop, this special welded assembly was delivered in one complete unit ready for quick, easy installation. Result: Each connection went together slick as a whistle without costly delays.

This is only one of several advantages you gain by using Armco Spiral Welded Pipe. As strong and durable as it is, you'll find it easy to handle, smooth inside, and adaptable to any type of joint. Diameters run from 6 to 36 inches; wall thicknesses from 12 gage to ½-inch. This together with a choice of base metals, lengths and optional coatings enables you to specify a pipe exactly suited to your requirements.

To aid you in determining where Armco pipe can be applied most economically in your plant, write for a free copy of Bulletin No. 337. The American Rolling Mill Co., Pipe Sales Division, 3151 Curtis St., Middletown, Ohio. District Offices in Key Cities.

ARMCO

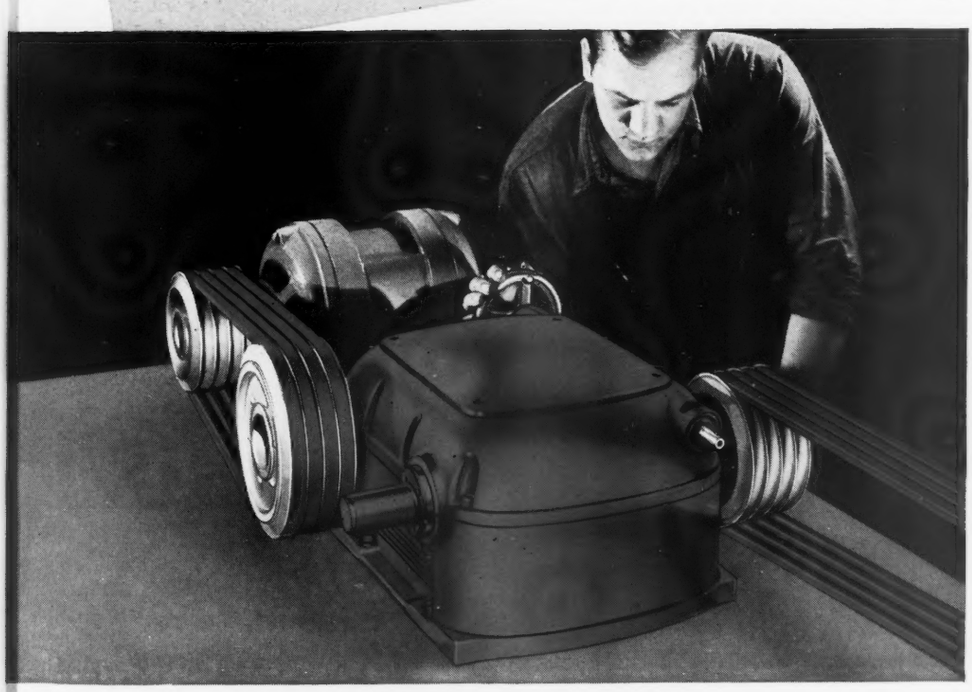
ARMCO SPIRAL WELDED PIPE

CUT WASTE!

The Sensational New Allis-Chalmers Vari-Pitch Speed Changer Beats Production Waste ...Power Waste ...Space Waste!

Cash in on the Extra Benefits this Fast-Selling Variable Speed Transmission gives You!

CUT PRODUCTION WASTE! You get easy, time-saving operation with the new Allis-Chalmers Vari-Pitch Speed Changer. Once the setting is made, it remains constant . . . no springs to get out of order. You don't have to stop production to change speed . . . no preliminary guesswork. And . . . you don't need expensive multi-speed motors or separate changeovers. The Vari-Pitch Speed Changer is coupled to a standard, low cost, high speed motor . . . starts cutting costs right there!



CUT POWER WASTE! You get the most out of your power dollar with the Vari-Pitch Speed Changer. Dynamically balanced Vari-Pitch Sheaves, anti-friction bearings, and tough Texropes reduce power waste to a new low! And remember . . . a series of actual load tests has proved the efficiency of the Vari-Pitch Speed Changer. It's 95% efficient!

CUT SPACE WASTE! You get a variable speed transmission that occupies only ¼ to ⅓ the space that other, bulkier transmissions require. Avoid space-wasting layouts! Put the Vari-Pitch Speed Changer wherever you want it . . . double shaft extensions permit it to be driven from either side or either end . . . by Texrope Drive or by direct connection!

Cash in! No other variable speed transmission on the market today gives you all these **extra** values. Get the details. Send for Bulletin 1266 . . . or call the District Office nearest you. Find out what the Allis-Chalmers Vari-Pitch Speed Changer can do in your plant to cut production waste . . . power waste . . . space waste!

OPERATORS LIKE the new Vari-Pitch Speed Changer because it makes speed changes easy . . . quick . . . constant. Plant managers like it, too . . . because it cuts waste in production . . . in power . . . and in space! Available in sizes from 1 to 33 hp, ratios up to 3¾ to 1, maximum output speed 3500 rpm, the Vari-Pitch Speed Changer is a product of Allis-Chalmers Mfg. Co., originators of the Texrope Drive and the Vari-Pitch Sheave.

Vari-Pitch Speed Changers • Texrope V-Belts • Duro-Brace Texsteel Sheaves • Vari-Pitch Sheaves • Standard Cast Iron Sheaves • Adjustable Pitch Diameter Texsteel Sheaves • 2-3-4 Combination Sheaves • Straitline Automatic Motor Bases • Oil Field Drilling Rigs

Belts by Goodrich

TEXROPE DIVISION

ALLIS-CHALMERS

MILWAUKEE·WISCONSIN

"ALLIS-CHALMERS MOTORS HELP US TO PROTECT OUR REPUTATION"

Another true case history from the Allis-Chalmers files that proves **"IT PAYS TO BUY THE EQUIPMENT THAT PAYS FOR ITSELF!"**

Read what E. F. Kieckhefer, Vice-President, A. Kieckhefer Elevator Company, Says about Allis-Chalmers "Lo-Maintenance" Motors... How They Save Money... Build Customer Good Will! Get the Details on How You Can Cut Your Costs... Make Your Plant a Bigger Money-Maker with the Equipment that Pays for Itself!

You can't take chances with the motors you buy when you're in the elevator business! Breakdowns mean building traffic jams . . . tied-up freight . . . wasted time and wasted dollars! And you can't build customer good will that way!

The A. Kieckhefer Elevator Co., of Milwaukee, Wis., has built elevators for 56 years. And in that time they've built themselves an outstanding reputation throughout North and South America for elevators that set low cost maintenance records . . . that don't break down!

Can't Take Chances with Reputation!

That's why E. F. Kieckhefer, helps protect his company's reputation with Allis-Chalmers "Lo-Maintenance" Motors!

"You need motors in elevator work," he says, "that are tough . . . that can take the terrific abuse of repeated starting and stopping . . . without failing.

Selling Elevators Means Selling Service!

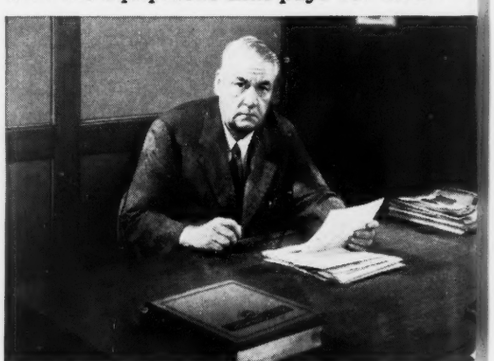
"And selling the service our motors will give is just as important as selling the elevators themselves. Our customers demand equipment that will stand up even under the most adverse conditions without money-wasting shutdowns!

"That's why for twenty-five years I've practically always specified Allis-Chalmers Motors for our equipment. Our customers get better service, saving money in maintenance costs. And we don't get complaints! Allis-Chalmers motors help us protect our reputation as builders of elevators that don't break down!"

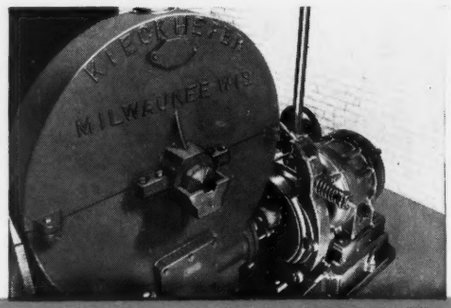
Allis-Chalmers Guards Profit Margins!

Allis-Chalmers "Lo-Maintenance" Motors are some of the Allis-Chalmers equipment that protects profit margins in plants throughout the world. And Mr. Kieckhefer is one of the thousands of executives who have found it pays to buy the equipment that pays for itself!

Get the whole story! There's an engineer, trained in solving production problems, in the Allis-Chalmers District Office near you. Find out how he can put 90 years of engineering experience to work . . . to increase your profit margin with the equipment that pays for itself!



E. F. Kieckhefer checks specifications at his desk in the Milwaukee plant. BELOW: The elevator drum of a Kieckhefer installation with an Allis-Chalmers "LO-MAINTENANCE" motor.



MOTORS FOR ALL APPLICATIONS FROM ½ HORSEPOWER AND UP

ELECTRICAL DIVISION
ALLIS-CHALMERS
MILWAUKEE · WISCONSIN

SHAFER

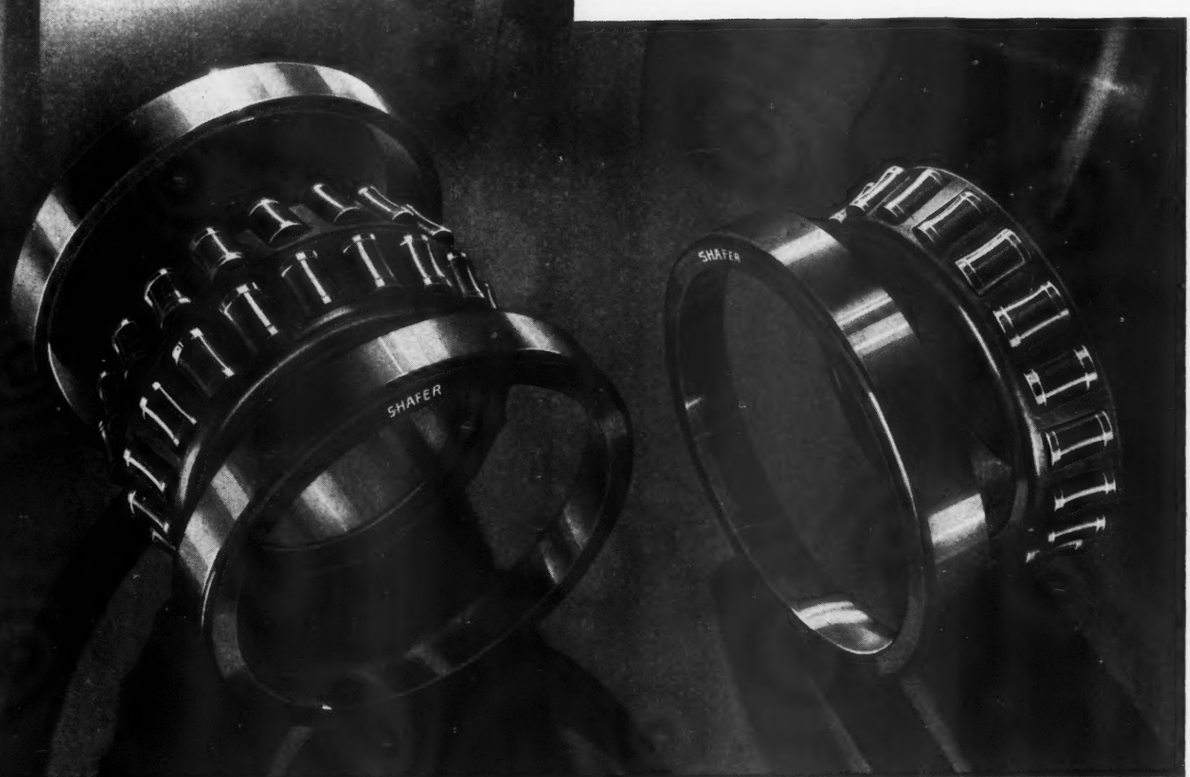
adjustability cuts replacements

The CONCAVE roller design gives the Shafer bearing its built-in self-alignment, radial-thrust capacity, and provision for simple adjustment. This important feature of adjustability allows proper compensation for wear, and greatly extended bearing life at high efficiency. Only Shafer has the simple, effective concave roller design, assuring consistently superior service under severe operating conditions.

Available in a full range of sizes: Pillow Blocks • Flange Units • Take-up Units • Cartridge Units • Flange-Cartridge Units • Duplex Units • Hanger Boxes • Conveyor Rolls • Radial-thrust Roller Bearings

Write for Catalog 14 with complete listings and engineering data

SHAFER BEARING CORPORATION
35 EAST WACKER DRIVE, CHICAGO



SELF-ALIGNING ROLLER BEARINGS

from this Necessary Expense an unexpected profit

Insurance isn't all out-go.

Even in the case of workmen's compensation insurance, which benefits employees . . . the employer has opportunity to *profit* as well as to pay.

The employer who insures with American Mutual receives *three* opportunities to profit . . . on top of the security he feels in knowing his insurance is in the hands of America's pioneer liability company—with 51 years of resource-building to back up *his* protection.

American Mutual safety engineers help to reduce his premium costs through more favorable accident experience . . . American Mutual doctors often restore the job-holding ability of experienced men whose injuries might have crippled them for life . . . and American Mutual's cash dividend feature makes possible a one-fifth reduction in insurance costs.

What these extra profits amount to in dollars and cents — is impossible to say. Yet we do know that firms have saved thousands in premium reductions, up to tens of thousands a year in dividend returns, and an uncountable benefit in the experience of valuable men returned to their jobs.

A new booklet, "How 12 Companies Saved More Than A Million Dollars", giving examples of actual profits, will show how this lowest-net-cost insurance may bring unexpected profits into *your* plant. Address 142 Berkeley St., Dept. 55, Boston, Mass.

American Mutual

works to make all work safe

American Mutual has branches in 56 of the country's principal industrial centers. In addition to Workmen's Compensation, it offers opportunity for savings on Automobile, Fidelity Bond, and practically all other lines of liability insurance.

Admitted Assets: $34,866,615.84 Liabilities: $29,443,222.08
Surplus to Policyholders: $5,423,393.76 As of Dec. 31, 1937

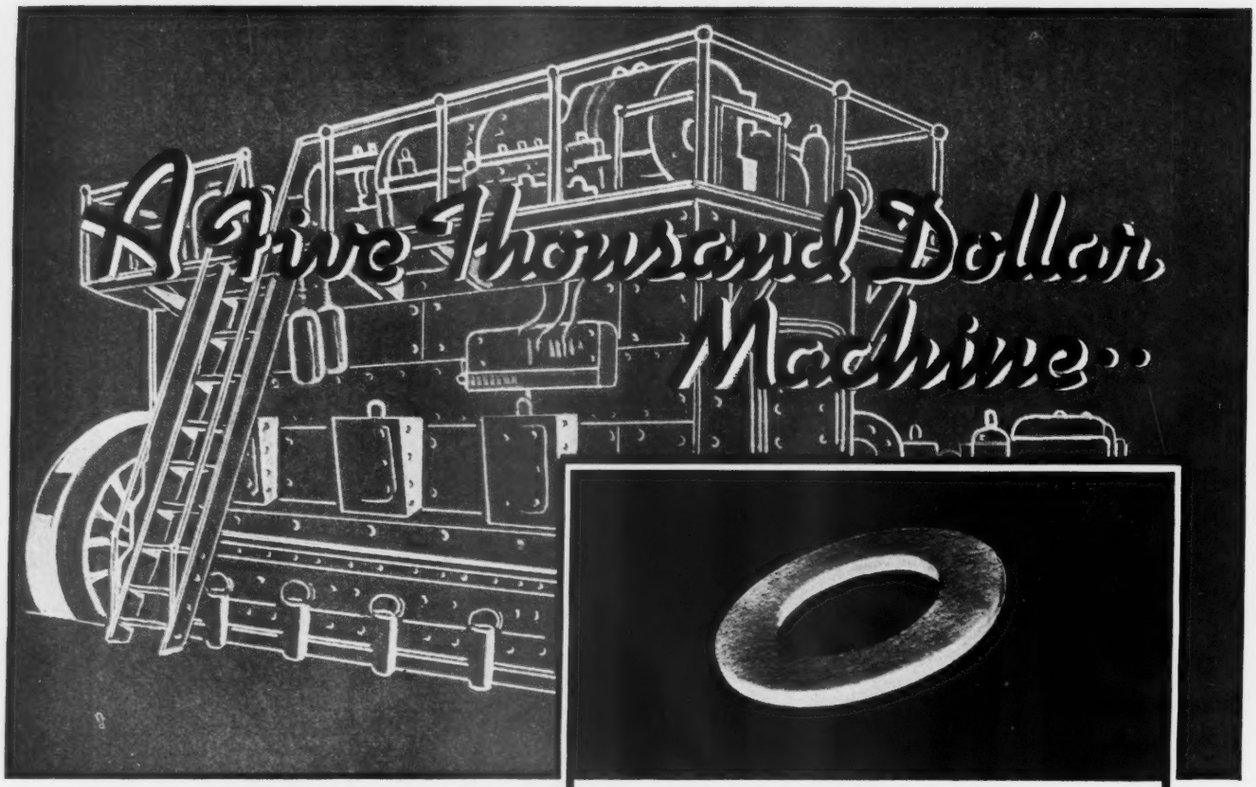
Savings even greater than 20% have been made regularly on Fire Insurance, written by our associate, Allied American Mutual Fire Insurance Co.

AMERICAN MUTUAL LIABILITY INSURANCE COMPANY

A PROFIT FROM SAFETY ENGINEERING
that, through analysis of past records and present conditions, through establishing safety-mindedness among all employees as well as mechanically safeguarding their machines, and through coordinating men, methods, and machines in sound safety practice, reduces indirect accident losses and saves on production cost.

A PROFIT FROM MEDICAL REHABILITATION,
through the service of American Mutual doctors who, trained in industrial surgery and familiar with the requirements of most industrial jobs, can shape the course of the treatment so that an injured man can again make use of the skill he has acquired.

A PROFIT IN CASH DIVIDENDS.
American Mutual's record of returning to all policyholders a cash dividend of 20% or more each year since organization in 1887—is the longest dividend record of any mutual liability insurance company . . . evidence of security that no other company can offer.



DEPENDANT UPON FIVE CENTS WORTH OF *Felt*

A small felt washer in a large and expensive machine may be the difference between efficient, economical operation and costly, slip-shod inefficiency.

For many years, we have manufactured felts for mechanical uses and cut them into washers, gaskets, strips, etc. During this time we have supplied these small, but all-important parts for the finest automobiles, engines, and industrial machines that this country has produced. Our mechanical felts, made of the famous Felters' Certified Felts, carry the Certified Felt label as QUALITY FELT INSURANCE for the felt buyer.

We have published a folder describing the reasons behind CERTIFIED FELT. We explain why the Certified Felt label is an aid to the buyer. Send for your copy today. Address The Felters Company, Inc., Dept. AB, 210 South Street, Boston, Mass.

THE FELTERS COMPANY, INC.

210 SOUTH STREET, BOSTON, MASSACHUSETTS

Mills at Johnson City, N. Y., Millbury, Mass., Jackson, Mich. *Offices at New York, Chicago, Philadelphia, Detroit, St. Louis, Dallas, San Francisco*

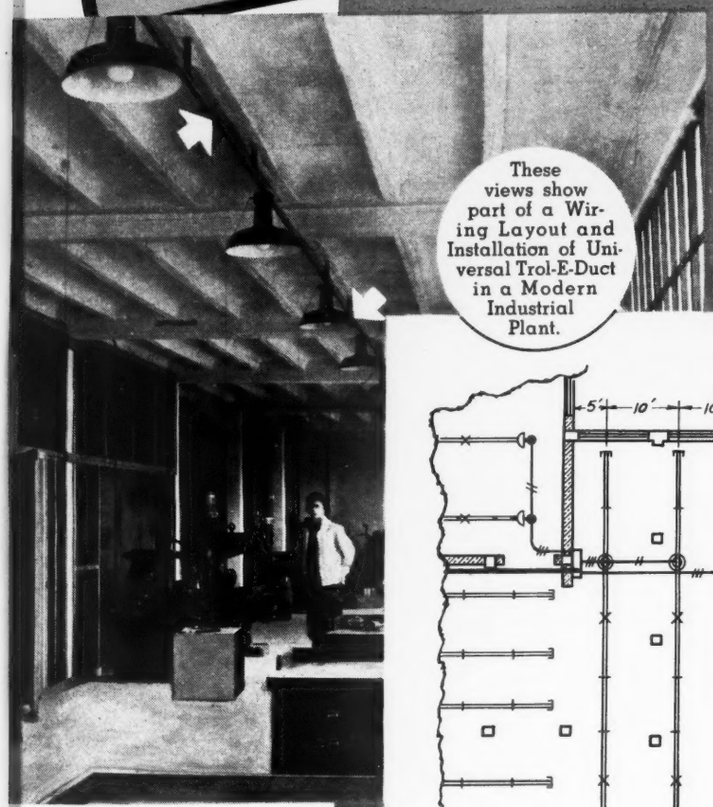
ECONOMICAL • CONVENIENT • FLEXIBLE

BULL DOG Trol-E-Duct UNIVERSAL TYPE

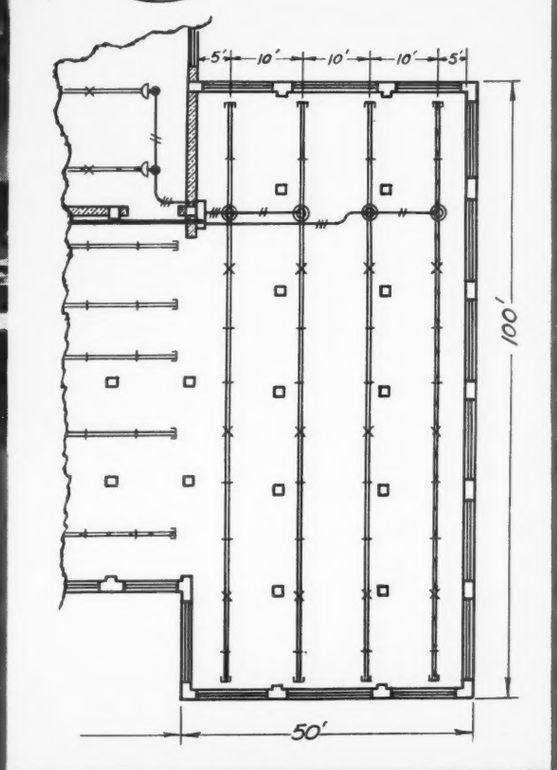
THE *Modern* WIRING SYSTEM WITH MOVABLE or SEMI-FIXED Outlets

Trol-E-Duct is a continuous Busway System of Electrical Distribution . . . *Movable* current collecting Trolleys which may be moved along the Duct run or *Semi-Fixed* Twistout Plugs which can be inserted at any point in the Duct, serve as current sources for Lights, Portable Tools and other devices . . . The flexibility of *Movable* Outlets or the creation of *Fixed* Outlets at any desired point, is equally available.

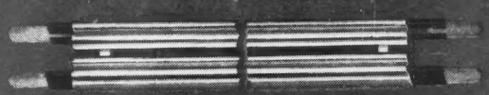
A complete line of Duct Sections, Couplings, Elbows, End Caps and other fittings provides a prefabricated Wiring System to fit the layout of any building. Ease of installation or removal is also a feature of the system.



These views show part of a Wiring Layout and Installation of Universal Trol-E-Duct in a Modern Industrial Plant.



The symbols shown on the Wiring Layout represent various sections or parts of the Trol-E-Duct System as indicated.



10 Ft. Duct Sections, Catalog No. D210

Plain Coupling Catalog No. C210

Trolley Entrance Coupling Catalog No. TC210

Trolley Entrance End Cap Catalog No. TEC210

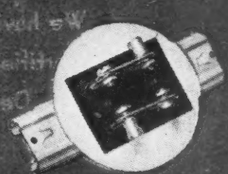
Feed-in End Cap (cover removed) Catalog No. NEP2503

Hangers Catalog No. H210-0

Conventional Outlet Box

Bull Dog Kbl-Duct (For Feed Wires)

Bull Dog Distribution Center



Feed-in Coupling Catalog No. FC210

The Movable TROLLEY which, with its connected Load, can be moved along the Duct Run. Extension cord not included.

The Semi-Fixed Twistout PLUG which, with its connected Load, can be plugged-in at any point in the Duct. Extension cord not included.

WRITE FOR POCKET SIZE BOOKLET:
"How to Mobilize Lighting and Power Outlets with TROL-E-DUCT"

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BULL DOG ELECTRIC PRODUCTS COMPANY

Pioneers In Flexible Electrical Distribution Systems

DETROIT, MICHIGAN

BULL DOG ELECTRIC PRODUCTS OF CANADA, LTD., TORONTO, ONT.

PIONEERING . . .

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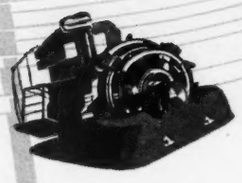
THERE IS A COMPLETE LINE OF TYCOL LUBRICANTS

AND PROGRESS

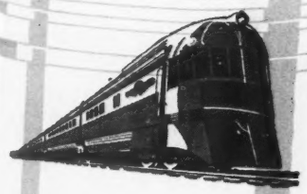


STATIONARY

21,000 hours on one of the most modern types of 525 H.P. stationary Diesels—typical of many Tide Water performances in this field.

BUSES

Over 1,600,000 Miles of success in lubricating the first and largest fleet of Diesel-electric buses in America.



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Over 580,000 Miles of Tide Water lubrication on the "Flying Yankee," the first streamlined train in the East.

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Tide Water has over thirty years of experience in the lubrication and actual operation of Diesel Engines. It started with the purchase, in 1905, of a Diesel Engine for pumping crude oil through Tide Water's pioneer pipe line—in the earliest years of Diesel operation in America. Tide Water was truly a pioneer—a leader in Diesel Engine lubrication performance.

Research and practical field experience have maintained Tide Water's leadership in this type of lubrication. Witness some of the record performances of today on the most varied and modern of Diesel Engines.

Operators everywhere find profit in the superior refining of Tide Water Diesel Oils. They are specially processed to maintain high stability and their freedom from harmful residues prevents costly piston ring sticking. RESULT: Maximum operation, less overhauls, lower maintenance cost.

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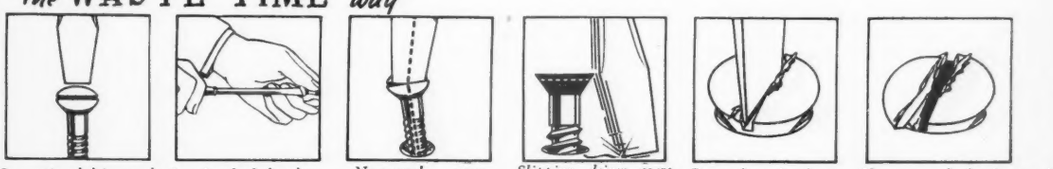
SCIENTIFICALLY ENGINEERED FOR EVERY INDUSTRIAL USE

So cost departments say — "It's CHEAPER to drive Phillips"

The manufacturers who were the first to standardize on patented Phillips Recessed Head Screws are the ones who have to cut costs without cutting quality — airplane factories, auto body makers, electrical appliance manufacturers, fine furniture makers. On all counts they've learned that the Phillips Screw is a low-cost fastening — faster assembly, less spoilage, fewer screws, longer tool life, better worker attitude. No wonder they say, "We could not afford to be without Phillip's Recessed Head Screws."

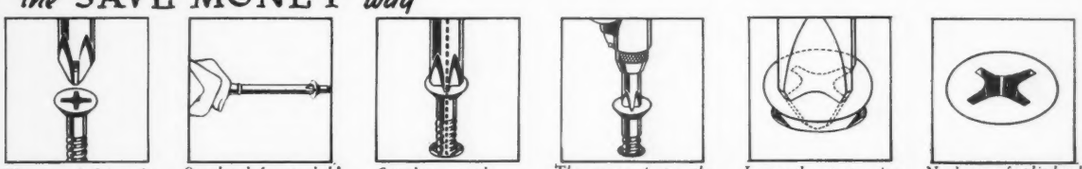
MEANWHILE, quality won't suffer. In fact, quality is improved — as evidenced by the fact that many manufacturers are instructing salesmen to make a sales point of the new fastening method. The public is learning that products assembled the Phillips way are stronger, more resistant to vibration, better-looking and safer. Any of the manufacturers listed below will tell you more. Ask for Folder B.

the "WASTE TIME" way



Conventional driver and slotted head screw — *It takes both hands to start and drive* — *No control — screw goes in crooked* — *Slipping driver scars surface or injures workman* — *Driver loose in slot tears the metal* — *Slotted screw's head may split when tightening*

the "SAVE MONEY" way



The tapered driver fits the Phillips recess — *One hand free to hold work — no screws dropped* — *Complete control — straight-line driving* — *The recess keeps the driver from slipping — no scars* — *Increased contact makes driving easy — prevents burrs* — *No danger of split head — screw can be set up tighter*

This is the Genuine Patented Phillips recessed head

— proven most successful for all types of industrial fastening.

Note the tapered recess in the screw — its angle was worked out after months of tests to determine the most efficient form of recessed head, utilizing the driver's *maximum* turning power. Note the flat surfaces — no curves except at the rim. That prevents the driver from burring the screw. Cold forged to tolerances of plus or minus .001″ — to guarantee a perfect fit.

ANY TYPE OF DRIVER CAN BE USED

FEWER DRIVER SIZES — 2 sizes of Phillips Drivers fit 85% of all screw sizes commonly used. 4 driver sizes fit the entire range of screw sizes, instead of 7 as with slotted screws. Made by many leading driver manufacturers. Ordinary drivers can also be used.

PHILLIPS RECESSED HEAD SCREWS

Gain Time . . . Guide-Driver . . . Guard Work

U. S. Patents on Product and Methods Nos. 2,046,343; 2,046,837; 2,046,839; 2,046,840; 2,082,085; 2,084,078; 2,084,079; 2,090,338. Other Domestic and Foreign Patents Allowed and Pending.

MACHINE SCREWS — SHEET METAL SCREWS — WOOD SCREWS — STOVE BOLTS

CLIP HERE AND MAIL TO ONE OF THESE MANUFACTURERS

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Providence, Rhode Island

Continental Screw Company
New Bedford, Massachusetts

Corbin Screw Corporation
New Britain, Connecticut

National Screw & Manufacturing Company
Cleveland, Ohio

Parker-Kalon Corporation
New York, New York

Russell, Burdsall & Ward Bolt & Nut Co.
Port Chester, New York

Please send me — without obligation — Folder B on patented Phillips Screws.

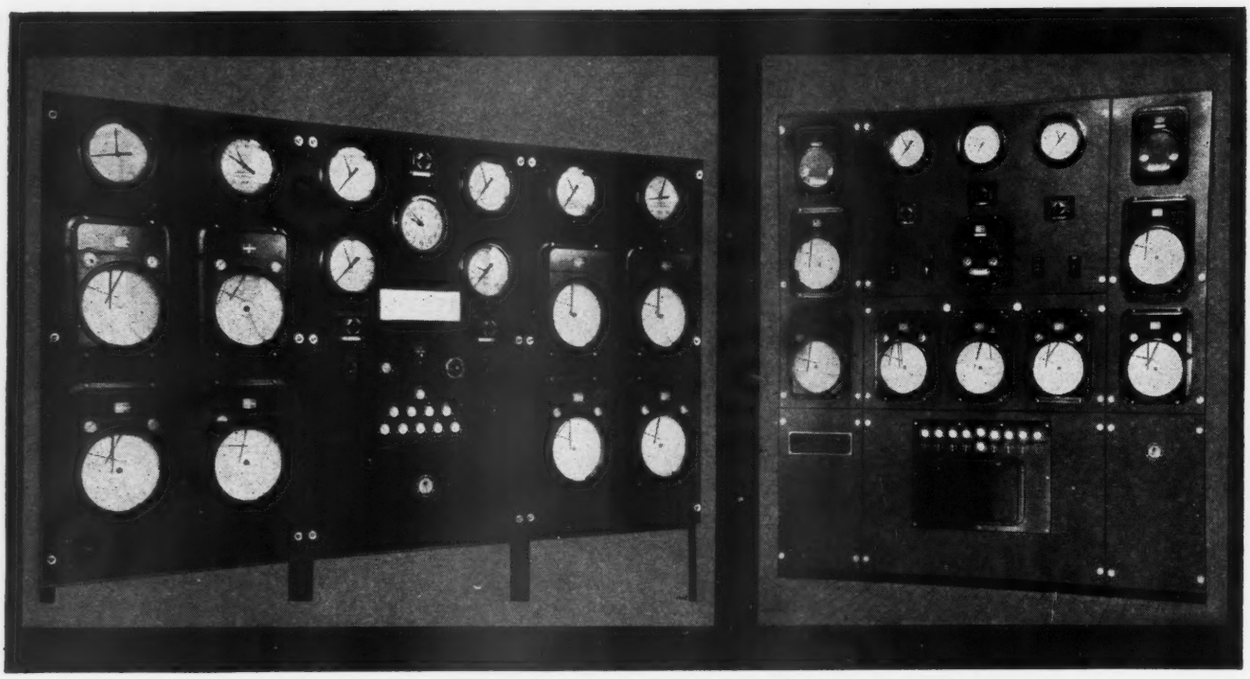
Name .....

Company .....

Address .....

Bristol's System of
COORDINATED PROCESS CONTROL

COMPLETELY AUTOMATIC CONTROL OF PLANT PROCESSES . . . THE MODERN TREND IN INDUSTRY . . . INSURES PRODUCT UNIFORMITY



These Coordinated Process Control Systems automatically operate and control a chemical process in a large, successful manufacturing plant associated with the automotive industry.

This Modern Technique of Process Control is now being used by some of the most progressive and successful manufacturers in the country

Bristol's System of Coordinated Process Control is an engineered system of automatic control instruments and devices built in the form of a master control station. It provides for coordinating and interlocking of all of the vital events of a process so that they take place in successive steps and proceed only after the previous function has been concluded. This system is for use in operating industrial processes that depend for their complete success on the rigid control of such factors as the time of operation of valves (all sizes up to large gate valves), pumps, blowers, dampers, etc., and the control at a definite value or according to a time program, of such variables as temperature, pressure, liquid level, flow, humidity, speed, vapor concentration, etc.

With Bristol's System of Coordinated Process Control it is now practical to automatically control and operate under plant conditions a whole industrial process from beginning to end, regardless of how intricate it may be, and thus make the process live up to the plan as established by the best technical advice. This duplication, day in and day out, of standard practice with scientific, completely automatic control facilitates production, saves time, eliminates rejections, conserves processing ingredients, increases yields, assures a uniform product of predetermined quality and solves many other production problems that in the end result in GREATER PROFITS.

A conference with your engineers will determine just how effectively it can be applied in your plant and the results that can be expected from its use. We would like to send Bulletin 460F and Bulletin 511F.

THE BRISTOL COMPANY
WATERBURY, CONNECTICUT
Branch Offices: Akron, Birmingham, Boston, Chicago, Detroit, Los Angeles, New York, Philadelphia, Pittsburgh, St. Louis, San Francisco, Seattle. Canada: The Bristol Company of Canada, Limited, Toronto, Ontario. England: Bristol's Instrument Company, Limited, London, N.W. 10

BRISTOL'S
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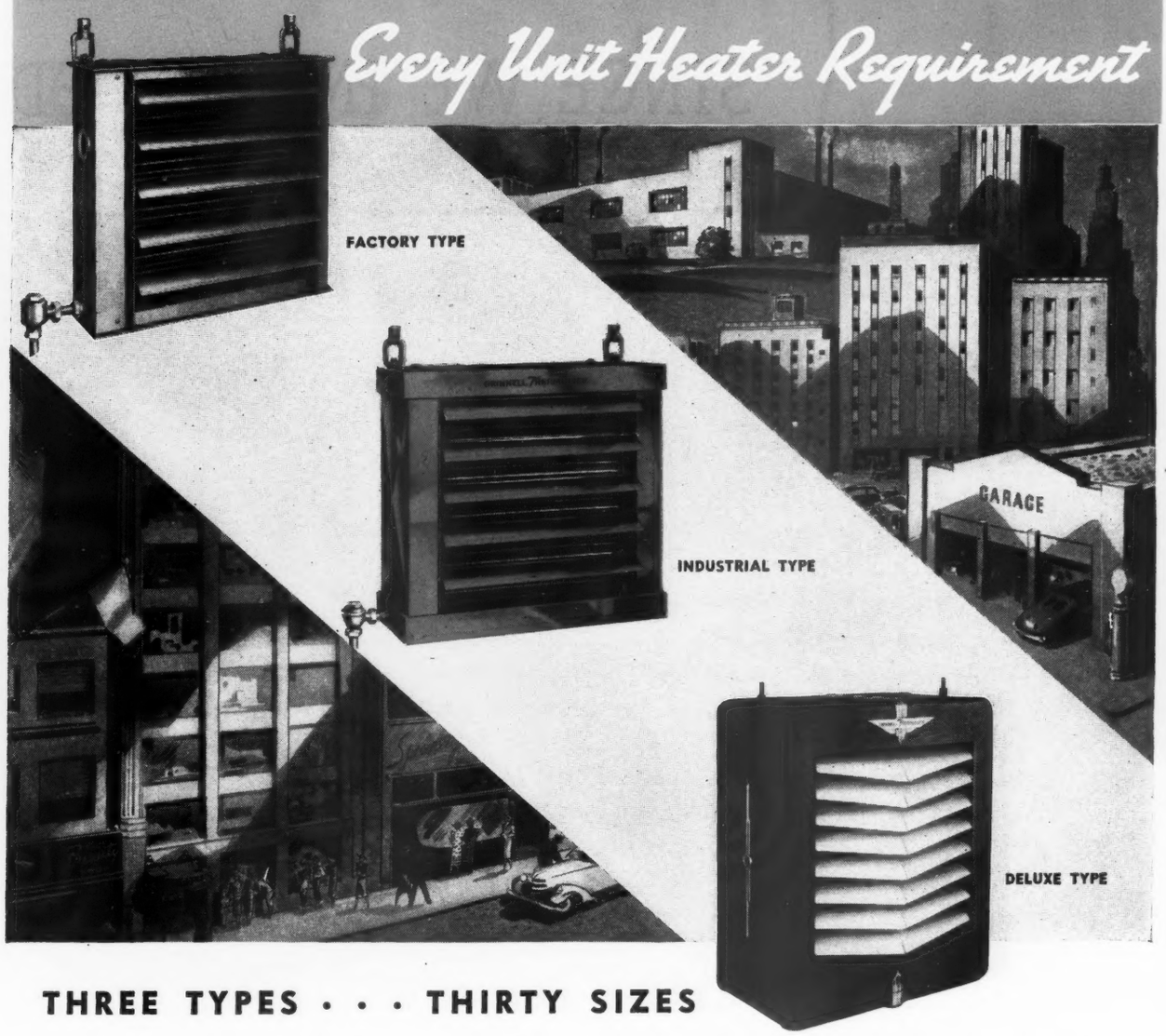
THERE IS A THERMOLIER *To meet Every Unit Heater Requirement*



THREE TYPES . . . THIRTY SIZES

No matter what your heating requirements are, you may safely specify "Grinnell Thermolier." For eighty years of heating experience are back of Thermolier's three types and thirty sizes. Thus each Thermolier installation is "tailor-made" to fit the exact requirements of an individual building and an individual heating condition. Each model, each size, embodies the exclusive Thermolier Internal Cooling Leg which continuously drains "lazy water", keeps all of the heater working, all of the time . . *plus* thirteen other exclusive Thermolier features. You can count on heating satisfaction and fuel savings when you install Thermoliers. Write for the Thermolier Catalog. Grinnell Co., Inc., Executive Offices, Providence, R. I., Branch offices in principal cities of U. S. and Canada.

GRINNELL THERMOLIER

THE UNIT HEATER WITH 14 POINTS OF SUPERIORITY

"I FIGURE WE SAVED SINCE WE INSTALLED

. . HERE ARE THE FACTS

says Mr. E. K. Sprague, Electrical Engineer, The Patent Button Co., Waterbury, Conn. "We were averaging about three complete shutdowns a week due to main fuses blowing.

"On January 28, 1938, we installed BUSS Super-Lag Fuses. To date (April 16th) we have not had a single shutdown.

"I figure this is due to the design of the BUSS Fuse and to the eliminating of poor contact at the clips—and that the combination saved the company at least $100.00 a week."

BUSS *Super Lag*

ABOUT $100.00 A WEEK BUSS FUSES"!

You too, can

ABOLISH WASTEFUL SHUTDOWNS CAUSED BY NEEDLESS BLOWS

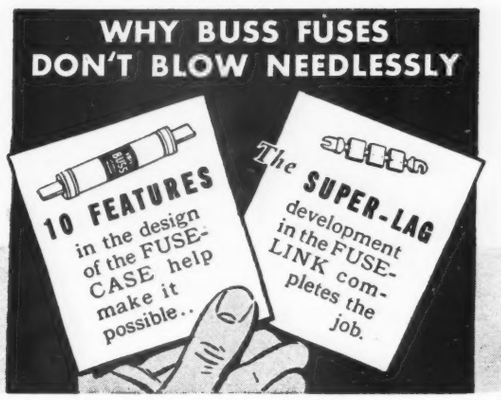
It may come as a surprise to some executives that many shutdowns supposed to be caused by trouble in the circuit, really originate in the protective devices themselves.

To prevent this costly waste – caused by protective devices opening needlessly – BUSS developed the Super-Lag fuse.

If you are even remotely interested in a smooth running plant – or saving money due to more efficient plant operation – you will find it well worth your while to pass the word along that in the future all requisitions and purchase orders call for BUSS Super-Lag fuses.

If you would like to be able to show others why BUSS Fuses are suited to the needs of your plant we will be glad to send you a copy of the RB book. It gives in easy reading style a comparison of BUSS construction with others – and makes clear how BUSS Super-Lag Fuses can help abolish unnecessary shutdowns in your plant.

BUSSMANN MFG. CO.
2536 W. University St.
ST. LOUIS
Division McGraw Electric Company


WHY BUSS FUSES DON'T BLOW NEEDLESSLY
10 FEATURES in the design of the FUSE-CASE help make it possible..
The SUPER-LAG development in the FUSE-LINK completes the job.

FUSES

Your POWER TRANSMISSION

ADVANTAGES OVER BELTS OR ENDLESS ROPES

—equal or lower first cost in many instances.

—no dismantling of machine or removal of sheaves or pulleys to make repairs.

—no "machine down" time as when renewing "endless" belts.

—positive action assures full productive capacity of the machine.

—easy to install...just connect the ends of the chain.

—safety to employees...operate in oil-retaining casing.

—require practically no attention or upkeep.

—give up to 25 years' service and longer.

LINK-BELT *Silverstreak* SILENT CHAIN DRIVES

Worries are Over —

WHEN YOU INSTALL LINK-BELT *Silverstreak* SILENT CHAIN DRIVES

● No more worry about slipping, inefficient belts—no more frequent drive replacements with machines down and costs up. Instead, every machine operating at its full rated capacity—every R.P.M. of each motor being delivered to its machine. That's what Silverstreak silent chain drives can mean to you.

You'll like their dependable, trouble-free performance. They require little attention — little upkeep expense to keep them operating at top efficiency for 10, 15, 20 — yes, even 30 years and longer. The fact is, there's no other drive that can make your life happier — both in freedom from operating worries and in keeping costs down — than Link-Belt Silverstreak silent chain drives. Drives carried in stock — ½ to 60 H. P. — by distributors throughout the country. Larger Horse Powers supplied from the factory on short notice.

LINK-BELT COMPANY

The Leading Manufacturer of Positive Power Transmitting Equipment

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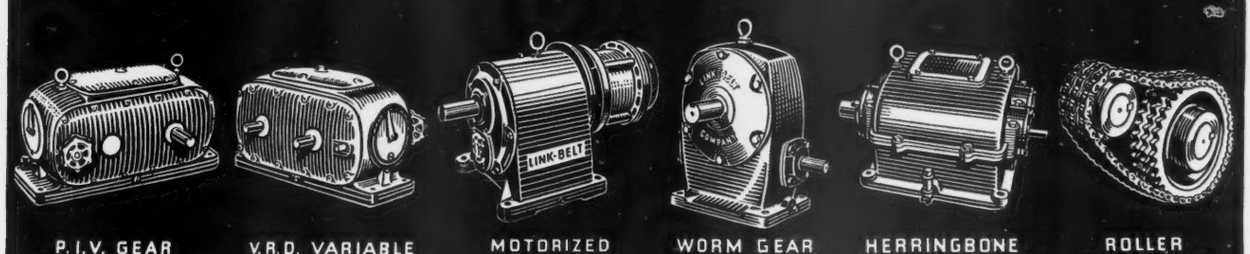
7353

● Send for this 96-page engineering data book No. 125. It shows how to figure drives and determine prices.

OTHER LINK-BELT POSITIVE DRIVES



P. I. V. GEAR SPEED VARIATOR | V. R. D. VARIABLE ROLLER DRIVE | MOTORIZED REDUCER | WORM GEAR REDUCER | HERRINGBONE GEAR REDUCER | ROLLER CHAIN DRIVE

WHAT! CUT WASHROOM EXPENSES WITHOUT LOSING EMPLOYEE GOOD WILL!

Yes! Here's how a "Washroom Tour" will open your eyes . . . save you money

EVERY WORKER in your plant or office visits the washroom several times a day. Here is the one place employees come face to face with management's concern for their health and comfort.

That's why progressive management now provides clean, sanitary washrooms for worker and executive alike. In no other way can employee good will be created more *economically*, *lastingly*.

Plenty of basins, toilets, soap, hot water and a generous supply of *clean*, *individual* ScotTissue Towels—these are what your employees deserve and appreciate.

ScotTissue Towels are specially processed to make them pliant, clothlike and absorbent. One dries drier than several ordinary paper towels . . . that's why they go farther . . . cost you less per year per user. By installing ScotTissue Towels you'll positively cut expenses and provide a service for your employees vital in health protection.

Executives **wishing to improve washroom conditions in their plants or offices will be interested in the Scott Washroom Advisory Service. At your request, a Scott Washroom Engineer will make a scientific survey of your washroom facilities without obligation to you. He will suggest how your washrooms can be economically and efficiently arranged to relieve congestion, reduce waste and overhead expense, and create good will among your employees. Scott Paper Company, Chester, Pa.**

Thirsty Fibre Really **DRIES**

ScotTissue Towels

Trade Mark Reg. U.S. Pat. Off.

BY THE MAKERS OF SCOTTISSUE, WALDORF AND SCOTTOWELS FOR HOMES

Factory

Management and Maintenance

SEPTEMBER, 1938

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and

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BIGGEST AND TOUGHEST JOB that faces industry today is gaining the good will of the American people; only through mutual understanding can we build a better way of life. To help do this job FACTORY for October will contain a special section entitled "Public Relations in Industry." It will (1) stress the need for better public relations; (2) outline a public relations program; (3) set forth some basic facts that FACTORY readers can use in building their own industrial relations programs.

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Osborn Disc-Center Wire Wheel Sections with face plates are designed for use on modern high-speed stationary and portable grinders. For lower speeds and less severe work, these sections may be used without face plates.

100,000 More Parts Cleaned Per Brush Cuts Production Costs in Pennsylvania Plant

● Tests made by the manufacturer revealed that the Osborn Brush recommended for the work cleaned 203,000 metal parts compared to the 103,000 parts cleaned by the brush used formerly. The fact that the competitive brush cost 40 cents less than the Osborn Brush was insignificant. The manufacturer gladly paid 40 cents more for *the right brush for the job!*

It's good business to use good brushes! Osborn and the Osborn Distributor near you can help you select *the right brush for every production and maintenance need.* ASK ABOUT IT!

THE OSBORN MANUFACTURING COMPANY
5401 HAMILTON AVENUE • CLEVELAND, OHIO
Sales Offices: New York • Detroit • Chicago • San Francisco

Specify OSBORN Osborn Brushes

● THE MOST EXTENSIVE LINE OF INDUSTRIAL BRUSHES AVAILABLE FROM ANY SINGLE SOURCE

L. C. MORROW • EDITOR

Factory
Management and Maintenance

It Happened in Catlettsburg

SUPPOSE one John Smith applies to you tomorrow for a job. John, let us say, is the son of James Smith, an employee in your organization. You don't take John on.

Suppose, too, that a couple of years hence you are cited before the Labor Board. Suppose it is brought out that James Smith was, when you didn't hire John, a member of the CIO. Suppose the Labor Board contends that you didn't hire John because of his father's affiliation.

Suppose the Board is successful in its contention, and you are directed to hire John and pay him for the two years he didn't work for you.

Ridiculous, you say. At what rate would he be compensated for the time he didn't work? How long would he have worked at beginner's pay? How many promotions would he have had? Would he have worked full time, or part time, and, if the latter, how much? What of his social security taxes and records? If James's son could get back pay for not working, why not James's nephew, and his cousin, and his son-in-law? Why not the relatives of our other CIO employees?

And you are right, the whole thing is ridiculous. Yet consider this: Included in the complaint filed against the Ashland, Ky., plant of the American Rolling Mill Company is the charge that the company refused to employ one Harold Kirkman because his father, an Armco employee, was a CIO member. Kirkman, Jr., had never been employed by Armco.

Attorney William H. Gordon of the Labor Board contended, in the hearing at Catlettsburg, Ky., that if the company was found guilty of discrimination in failing to hire Kirkman, the Board would ask for his employment and back pay from 1936 when he first asked for a job.

Mr. Gordon's words, from the record: "We are seeking relief to the full extent of the National Labor Relations Act for Harold Kirkman. We are seeking affirmative relief for Harold Kirkman because of the discrimination against him. . .And, if the Board finds it advisable, to pay Harold Kirkman back pay for the two years he has not been employed by the company."

THIS SURELY is an amazing case. Unbelievable, yet there it stands on the record. Perhaps we should have a good laugh and let it go at that. On the other hand, maybe Mr. Gordon was serious.

CHARLES B. COATES
Assistant Editor

The Union of

FACTORY has many times advocated that labor unions accept the "responsibilities" that must accompany their increased powers. FACTORY has insisted that labor unions must "cooperate" with management in the interest of harmonious industrial relations and economic progress.

In this article we attempt to point the direction that union responsibility and cooperation can take. We follow the procedure of presenting case examples of the acceptance of responsibility by unions and their cooperation with management in furthering specific enterprises.

In our opinion it is the obligation of the union to recognize the need for efficiency in manufacture; the existence of a relationship between product costs and wage rates; the necessity for capital as well as employees to receive "wages." And we believe, also, that the union should cooperate with management to make manufacture profitable in order that there will be jobs for both employees and capital.

Not all the cases cited are ideal. Such cases are hard to find. The editor assigned to write the article has been uncovering and following his "leads" for months. He has interviewed labor leaders and management—has checked with both on the cases cited. Enough examples are given, we believe, to point the way to both management and union leaders.

When and if bona fide cooperation becomes universal; when and if the Labor Act is amended to be impartial; when and if the powers of the Labor Board are sufficiently curtailed; when and if a moratorium on further labor legislation is called—then industry will be in a position to render an ever-increasing service to society.—The Editor

ORGANIZED labor *can*, if it will, cooperate with employers in meeting management's problems. Some unions *do* help to cut costs, reduce waste, and increase production.

Management *can*, if it will, utilize unions as a means to efficiency. Some employers do. Certain industries rely on unions to stabilize conditions. Certain cities have found industrial peace in union-backed public relations programs.

Even in this, the most turbulent period in our industrial history, a period of guerilla warfare, coercion, and spreading government intervention, some surprising things can happen when progressive unions and managements get together.

Not long ago, an Eastern factory was about to close. To the worried directors came a union delegation.

"Our research department has been studying the plant," they said. "We believe it can make money. Your layout is antiquated, your materials handling costly. There's a lot of waste motion. We'd be willing to cut wages until things improve."

The factory stayed open and prospered, saving the investment for the owners, the industry for the town, and the jobs for the men.

By contrast, I recall a day when I sat in the office of one of the nation's foremost management men during a serious labor dispute. This manager was fair-minded, sincere.

. . . skilled negotiators, schooled in economics, help management effectively to meet industry's problems

But he had competitive difficulties and he was dealing with a brand-new, headstrong, aggressive union. Its leaders were shop committeemen—bang-up organizers, fighters.

"But there isn't a man among them I could place above the grade of foreman," sighed the manager. "Not one who has any conception of industrial problems. We negotiate slowly, working out simple arithmetic painfully. Finally they see my point. But all they can remember later is that they promised the men they would get them such-and-such—or else!"

This employer deserves a different sort of union to deal with, one far removed from the days when ham-fisted "delegates" roused their cohorts with stentorian bellows to battle with equally primitive bosses in a finish fight for spoils.

However, he hasn't lost his faith in the labor movement. He's far from blind to the greedy racketeers you find in some sections and the reckless firebrands in others.

"But the rank and file is sane," he says. "And some leaders are real executives. Just now the fighting type is on top but soon the call will be for administrators. Generals win wars; peace requires statesmanship. More generals or more statesmen? That's partly up to management."

What Labor Wants

Now labor's aims are easy to understand—higher wages, improved conditions, security. Management's problems are more complex—finance, sales, layout, materials handling, production and cost control, power transmission, maintenance, light, heat, etc. Only one phase of a manager's job comes under the heading of "personnel," "labor relations," or what you care to call it, while organized labor is free to concentrate on this one thing. This is perhaps the chief cause of the turmoil which government now strives to moderate by means of many agencies.

Unfortunately these agencies—state and national labor boards and what not—are synthetic substitutes for the one brand of lubrication that will really free the friction-loaded bearings of industry.

And that is employer-employee cooperation, based on recognition of the principle that labor and management have a joint obligation to help competitive industry serve its first master, the consumer.

"Cooperation" is a noble word, but let's define it.

Well, the employer, in a mood of true-blue cooperation, not only sympathizes with labor's aims, but also works actively to achieve them, solely as a matter of good management.

The cooperative union, meanwhile, not merely understands management's problems, but does something effectively to meet them. Such a union employs skilled negotiators schooled in economics. Their aim is not to win a war but to make and keep a logical, profitable peace. Such a union takes a strong stand in be-

half of its members. But it is powerful enough to keep the strike on the upper shelf of its arsenal. It shuns government intervention, if it can, but it respects, and insists that employers respect, *voluntary* contractual agreements.

Research Set-Up Stressed

Such a union maintains a complete research bureau, fully informed on wages and conditions throughout its industry. Such a union never advocates blind opposition to technological improvement; instead, it helps introduce new machinery with the least possible distress to its members, knowing that the end-result will be increased low-cost output, increased sales, and more jobs. The top executives of such a union are men who would hold equally high positions had they chosen management as a career.

Such a union teaches pride of workmanship, fights waste. It maintains a staff of trained technical experts not only to improve its own standards but *to assist employers* who find it hard to meet union terms.

Such a union is the super-smart union of the future—the union of tomorrow!

Now let's define cooperation practically. Stirred first by the statement of a distressed employer and then by the discovery that employers can have such unions *if they get together and encourage them,* I have sought for some time examples of effective union-management cooperation. Some of these examples will sound like news though some are old enough to have been forgotten.

Railroad Cases

This is perhaps not the best time to speak of cooperation on the railroads since the rail unions and managements appear to have hit "dead center" in their wage negotiations. But the historic Baltimore & Ohio case remains on the records for all to ponder.

In 1922, the year of the shopmen's strikes, union leaders asserted that reduction of waste and inefficiency would do more good than a reduction in wages.

Daniel Willard, president of the B&O, took note of this contention. He retained Otto S. Beyer, Jr., a wartime engineer of the Federal Railroad Administration, to install a cooperation program on the B&O, beginning at the Glenwood shop, near Pittsburgh. What followed attracted world notice.

In shops still raw from the bitterness of recent strikes, grievances were cut 50 per cent, appeals 75 per cent. Frequent idea conferences produced 3,800 *accepted* suggestions in eight months. Glenwood alone produced a new fixture for holding valve bodies, a new hollow tap for staybolt sleeves, a ratchet and holder for filling grease cops—cost cutters all. Safety drives reduced lost time. Cooperative advertising brought new business.

The idea was copied in part by other roads. Canadian National Railways picked it up—and borrowed Beyer.

At CNR's Stratford, Ont., locomotive shops, a cooperative committee studied 91 ideas (63 from the men) and adopted 77. A welder found a way to cut the cost of brazing piston seats from 42.32 cents to 22.47 cents per piston. A carpenter redesigned the floors of tenders, using shorter boards. The saving in lumber was $753 a year in that one shop.

Said the late Sir Henry Thornton, president of CNR., "No general ever won victories with a discontented army ...We have 16,000 partners now instead of 16,000 employees.

If today's possible railroad strike is averted, the averting agency will be the National Mediation Board, official railroad conciliator under the Railway Labor Act, and itself a symbol of cooperation since the Act was adopted at the joint behest of unions and railroads. Beyer is chairman of the mediation board.

Photo-Engravers

A. J. Powers, one of the foremost employers in his industry, was made an honorary member of the International Photo-Engravers Union last year. At a dinner in his honor, he told of early conflicts with the union. But he learned in conferences, he said, that the union's officers were "capable, fair, upright." He praised President Edward J. Volz and Vice-President Matthew Woll, and he congratulated the union on keeping its members off the relief rolls during the depression, even when only one in three was fully employed. Anent the closed shop, he said:

"True, the cost of production is higher, because of the workers' shorter hours, increased compensation, and improved labor standards, but these increased costs are easily offset by the union's hearty cooperation in increasing production and quality."

This year the union opened a research department as a clearing house for technical information and a testing ground for new ideas. Its full-time director began his duties by offering his services to employers as well as members.

In 1919, the Photo-Engravers offered to pledge $500,000 for the financial assistance of distressed employers. It wasn't taken up, but the gesture was regarded as sincere.

West Coast Pulp

A notable case is the collective bargaining plan under which West Coast lumber mills from Canada to Mexico do business with 12,000 members of the International Brotherhood of Pulp, Sulphite, and Paper Mill Workers. Uniform contracts are negotiated at a sort of union-management "parliament." There is a standard system for settling grievances in the plants and a

WILLIAM GREEN

"Cooperation with management for the good of industry has always been one of the aims of the Federation," William Green, President of the American Federation of Labor, told a *Factory* representative. "It has been difficult to develop that fine relationship during these last few years of stress, but it will always be our aim.

"One of the essentials to true cooperation is full unionization with all controversial elements reduced to a minimum. One factor causing bitterness is the question of union recognition. Frankly I'm afraid we can't have anything like cooperation until that is eliminated as an issue.

"Unions should join with management in opposing unsound, unwise and costly government administration and in averting over-stringent regulations of every sort. The Federation has done so many times."

"supreme court" to hear appeals. Unauthorized strikes are outlawed, government intervention obviated. The companies concede the closed shop. The union agrees to work for "safety, economy, quality and quantity of output, cleanliness, and protection of property."

Amalgamated

As a result of the 1932 depression, one of America's oldest clothing firms, long non-union, seemed about to fail. A new production manager, brought in from a successful firm, threatened to resign unless the plant were organized by the Amalgamated Clothing Workers of America. This union has 12 technical experts who advise with management. The manager wanted their help in installing efficiency methods.

The firm is doing well now. The manager told me:

"I wouldn't have attempted to reorganize the plant without their help. They know more about piece rates and production methods than any single factor in the industry. But, above all, they handle the *human* problem, the problem of getting our 1,400 employees to give their best to the job far better than we could. We've increased wages steadily. They've increased production. We've been able to lower prices without cutting quality one whit. Our inventories are no higher now than last year and we've had no lay-offs."

In a midwestern city, the banks called the notes of a large clothing company. Amalgamated is in the banking business, owns the Amalgamated Bank of New York. When the union bank showed its faith in the company by offering a loan of $100,000, the local banks decided to see it through. With a loan of only $50,000 from Amalgamated, the company came out of the red.

* * *

"Cooperation in the clothing industry is no new thing," says Sidney Hillman, Amalgamated's president. "To a certain extent we feel justified in regarding ourselves as the custodians of general efficiency in the industry."

Not every employer loves the Amalgamated, of course. This union actually intrudes on management's domain. As early as 1909 it had contracts with firms as big as Hart, Shaffner & Marx stipulating that no major change in layout or equipment could be made without the sanction of a union-management rates committee. This bespeaks a union that policed the industry constantly—and still does—with a big stick. But most employers approve.

In 1924, a poor business year, Hart, Schaffner & Marx closed several shops and sought, by installation of new machinery, to cut costs in its huge Chicago plant. Opposition arose in the rates committee. But Amalgamated offered to participate in operation of an experimental plant. The union was given a labor cost budget to allocate as it chose. It also assumed responsibility for quality and discipline.

Cutters who had worked on "lays" of three or four garments at a time were enabled to work on 12 "lays" when pattern planning was turned over to the clerical department. In one plant the number of inspectors was cut from 25 to 13.

Garments from the new plant found a ready market and the efficiency transition was carried out in other plants. Many employees lost their jobs, but each was given $500 from a union-management fund.

* * *

A common principle in all these cases appears to be this—that employers who utilize the cooperation idea find that it elicits a *morale* that makes for efficiency. Union leaders say that is because the union belongs to the men—and some managers agree. Some companies also work through the unions in the public relations job of "selling" themselves to their employees.

Works Councils?

What, then, of the excellent works councils and employee representation plans so common a few years ago? They can't be counted out, certainly, for some survive today. But the survivors are more aggressive. Some have formed outside connections; several have asked signed agreements. Thus, if they are strong enough to exclude unions, these organizations virtually become unions themselves.

In any case, organized labor is top dog now, although it was counted out for perhaps the fourth time in its history five years ago. And it is the *active* problem which management must meet today. In general, the employers who have had most success in union relations have achieved it through *collective* action. Here are other case histories:

Hosiery Workers

When two employees of a Pennsylvania hosiery mill were fired, 37 others stopped work. They, too, were fired. The case came before George W. Taylor, Chairman of the Hosiery Industry, who hears about 200 such disputes each year in a "court" set up jointly by employers and the union as part of an industry-wide collective bargaining program

Chairman Taylor ordered the first two men reinstated *and the 37 permanently dismissed.*

Why? Beause the union contract included not only the closed shop

ROY W. MOORE

Roy W. Moore, President of Canada Dry Ginger Ale, Inc., and Chairman of the Employment Relations Committee, National Association of Manufacturers, read the accompanying article and made this comment:

"Both sides have been at fault. Many of us have failed to realize that this is a period of progressive change. The labor movement is no flash in the pan. It is here to stay and it is time for us to take a good look at it and, through the best brains at our disposal, fit it into its proper place in the national economy for the good of all.

"The seat of the trouble lies in the fact that organized labor has not always had representatives in the field (although its chief executives have been broad-gage men) who could study and understand every detail of a business and decide on the course that works to the best interests of the whole enterprise. I believe labor will have more worthy representatives as time goes on and I hope that the day is not far off when industrial fear of unionism will vanish.

"If the element of compulsion could be removed from our present labor relations, the unions could sell themselves on their merits to management, wage earners, and the consumer."

but also a rigid no-strike proviso.

"Their transgression was not against the company only, but also against the union because it challenged the sanctity of the contract and the word of the union," said the Chairman. The union supported the decision. Strikes, since then, have been nil.

As the hosiery industry's set-up took shape, $25,000 was spent for time study and research, half of which was contributed by the Amerian Federation of Full-Fashioned Hosiery Workers. Wages are now stable where once they fluctuated wildly. Even non-union shops pay the union scale save in a few scattered instances.

Printing Pressmen

A large employing orinter was engaged in an expensive wrangle with a press manufacturer over a printing press that wouldn't do its job. The manufacturer's men couldn't make the press work but insisted that the fault was not in the machine. Legal action was threatened.

The printer turned to the International Printing Pressmen and Assistant's union for advice. Two members of the union's technical staff came from distant cities, studied the press, and submitted a report contending that the machine was unfit for the work for which it was guaranteed.

Accepting their verdict, the manufacturer took back the press and refunded a payment of $40,000.

These union trouble-shooters have cleared up many threatened strikes by helping employers to meet the prevailing union scale and at the same time compete with other firms.

About 400 newspapers are mailed daily to the union's headquarters at Pressman's Home, Tenn. (site also of the union's fine sanitarium, and home for the aged). Each paper is scanned by the Pressmen's engineering department. Any printing defect is marked and the paper set aside. If the same defect appears in the next day's paper, a letter is sent to the paper's foreman with instructions for correcting the trouble. If correspondence fails, a technician goes to the newspaper, wherever it may be, examines the press, checks everything, and fixes it. If the fault lies outside the pressroom, he reports to the publisher.

Employers send their picked men to the Technical Trade School at Pressman's Home. This is postgraduate, so to speak, to the many apprentice schools which the Pressmen, like other unions, maintain throughout the country. (The Wage and Hour Law is a serious threat to the apprentice schools, by the way.)

C. S. CHING

"If we expect the worst of anyone, we will usually get it," C. S. Ching, Industrial and Public Relations Director of U. S. Rubber Products Company, told a recent United States Chamber of Commerce meeting. "But if we have sufficient confidence in our employees to believe that they want to do their best, then that is what we will get.

"If industry persists in its attempt to put handcuffs and leg-irons on organized labor, and organized labor goes along with the politicians to put more shackles on industry, some of these days we will both find ourselves where neither one of us can do anything . . . and the politicians will stand by and laugh at both of us."

Ladies Garment Workers

The companies that manufacture women's clothing thrive, die, multiply, detach, and reform constantly, like so many squirming microbes in a drop of water. Fickle fashion is the cause. Success depends upon a firm's ability to turn out styles that please the buyer. Yet today there is a definite stability to this industry which once was noted for sweatshops and cut-throat competition.

Stabilizing factor is the International Ladies' Garment Workers Union. No longer do jobbers (who buy the cloth and cut it) play the contractors (who do the sewing) off against each other, causing price chaos. No longer do shop committees wrangle over piece rates in each hole-and-corner shop, confounding the confusion by arriving at hundreds of different rates in hundreds of different shops.

Today piece rates for almost the entire dress industry, largest branch of the garment trades, are set uniformly and simultaneously by the Unit System of Price Measurements devised by ILGWU's time-study men.* This ingenious formula, utilizing certain operations basic in all the 175,000 different styles which arise annually, has eliminated guesswork.

For years, many contractors persisted in ruinous under-bidding. Because of their smallness (average 25 employees) they were hard for the most vigilant union to police. Now the union contract makes the jobbers responsible for the contractors' observance of wage minimums. A recent development is the "limitation of contracts" which requires a jobber to use only two contractors, if two is all he needs (some of them formerly used 40).

The union negotiates industry-wide contracts with the various employers' associations. These contracts include joint machinery for settling grievances with a tribunal for the voluntary arbitration of appeals. There is an Impartial Chairman of the Dress Industry and an Impartial Chairman of the Coat Industry to decide appeals. Going further, the coat industry has a voluntary code of fair trade practice, the National Coat and Suit Industry Recovery Board which has been described as "a sort of chamber of commerce with labor in it."

Dress Industry Chairman Harry Uviller, who has handed down 2,000 decisions in two years, is an eloquent advocate of the voluntary principle in arbitration and a lucid proponent of union recognition. Until a union is secure, states Mr. Uviller, it cannot afford the "luxury" of cooperation.

The ILGWU is secure because of its big membership (225,000), its big income ($5,000,000 a year), its unparalleled benefits to members (in health, education, recreation, and social security) and its strong leadership (David Dubinsky).

Predictions abound that a period of comparative industrial prosperity may be at hand. With it may come a new wave of organizing aggression on labor's part. Management and labor have much to gain if they face this period with mutual determination to *eliminate loss through industrial warfare* (which cost them 28,000,000

* At the suggestion of Julius Hochman of the New York Joint Dress Board, this study was initiated by Francis Goodell and carried to completion by Thomas Cohen.

man-days—days of production and days of pay—in 1937) and share in every possible operating economy.

Management's outstanding gain, where the cooperative principle is applied, appears to be protection from strikes. Labor's major benefit is freely conceded recognition. The result, assured continuity of production, is the foundation on which a structure of positive progress may be raised far above a mere negative cessation of hostilities.

The wisdom of organizations of employers is amply pointed by Edward J. Mehren in his recent *Factory* survey of labor relations in Great Britain, where recognition has long since ceased to be an issue. For another thing, every *voluntary* step toward industrial harmony means a check on the increasing tendency to governmental regulation. Bound up in this question is labor's new tendency toward political action. The spectacle of CIO-Chairman John L. Lewis influencing legislation from the office of the Speaker of the House of Representatives is, to employers, a distressing one. The formation of an American Labor Party, which implies the development of a "class consciousness" foreign to our traditions, is hardly reassuring.

Recently politicians have been able to tell the American wage earner that recognition of his union is a cardinal political issue, that political action will get him what he cannot hope to gain by negotiation. But the "class struggle" psychology, which has put industry in shackles in Russia, Germany, and Italy, thrives on conflicts, melts in the presence of cooperation.

However, if straws show which way the wind blows, the cooperative movement is gaining new ground. San Francisco holds joint harmony conferences and 10,000 people turn out to hear a friendly discussion between labor leaders and an employers' committee. Evansville, Ind., hits upon a public relations program which promises industrial peace. Detroit, initiating a similar movement, calls on Donald Richberg and Edward F. McGrady (who installed one in Toledo) to get it going. In New York, a forum on employer-employee cooperation holds the attention of 500 at a National Industrial Conference Board meeting.

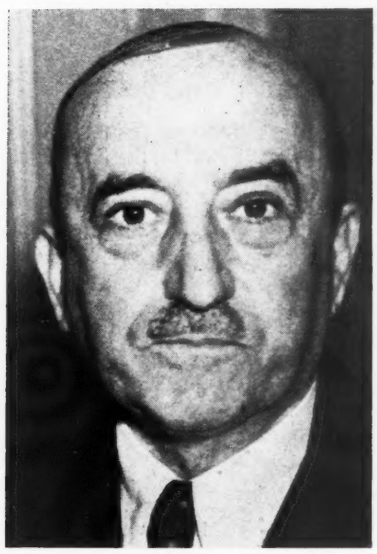
Meanwhile organized employers in certain industries hold to their purpose of collective bargaining on a broad front. The AFL's Union Label Trade Division continues its sales promotion exhibits in behalf of "union" employers. The fast-growing Bakery & Confectionery Workers Union boosts its products, "sells" its rigid health regulations as a guarantee of purity. The Steel Workers Organizing Committee, pausing after a bitterly militant organizing drive, publishes a handbook, "Production Problems," urging its local heads to initiate joint technical research committees and to retain experts to assist employers in eliminating waste, increasing production, and reducing seasonal lay-offs. Realistically it warns the locals to avoid selection of the "organizer type" for technical research work.

All rays of hope in a cloudy sky. The Amerian wage earner still thinks of himself (generally) as a citizen of the United States, not as a member of a world labor movement with his head full of political distractions involving Fascism, Communism, and whether Trotzky is right or wrong. Organized labor in America is massive, growing, unruly—but young. Will the cleavage be widened or will it be tied closer to a faith in capitalism?

Widespread cooperation may be, at best, a distant goal.

"We shall experience setbacks and disillusions," said Sir Henry Thornton. "We expect them. Ten, nay 20 years, will be a short time in which to create a sounder, healthier, and lasting attitude on the part of management towards legitimate unions, of unions towards management."

But there is hope, at least, that industry in the future may avoid some of the tragic conflicts that have marked the past—through the union of tomorrow.



EDWARD F. McGRADY

Asked for his views on the possibility of a new union-management cooperation movement, Edward F. McGrady, former Assistant Secretary of Labor, now Vice-President of Radio Corporation of America, told *Factory:*

"There's got to be cooperation. Management and labor are partners; they *must* get together for the good of industry and the public welfare. It is far better to do that than to run to the state and federal governments for help.

"More laws will follow laws. More laws mean less liberty for management and labor. In Germany, Italy, and Russia we have seen examples of the total loss of liberty for workers and leaders in industry with resulting lowered living standards. Compulsory arbitration hasn't worked in this country. If there is to be arbitration it must be placed on a voluntary basis."

SIDNEY HILLMAN

Cooperative service, not only to its members but to manufacturers, has been a policy for the Amalagamated Clothing Workers of America for many years, says the union's president, Sidney Hillman.

"Efficiency in the men's clothing industry has reached its highest point today," Mr. Hillman says, "and I think I may say that our policy has had something to do with it. We maintain a large research bureau and a technical staff that is constantly at the service of employers. We have helped many manufacturers to introduce efficiency methods because, in doing so, we knew we were helping our members by enabling their employers to stay in business on a competitive basis.

"Industry-wide union organization is, of course, essential if cooperation and efficiency are to be brought to this degree."

SWEDEN'S

A.-B. Text & Bilder

This first-hand study rounds out Factory's examination of labor relations in New Zealand (February), Australia (March and April), France (May), Great Britain (August)

SHOULD a delegation of American employers happen into Norway and Sweden to study labor relations, it is quite likely that most of them would say: "Here's one thing we've been looking for—a labor agreement that is truly a contract." For in both these countries a labor agreement is enforceable in the special labor courts; the party injured by an illegal stoppage, in violation of an agreement, can recover damages from the other.

The two countries also have compulsory conciliation, which means that when a stoppage of work is threatened, employers and workers *must meet and negotiate*. But they are not compelled to reach an agreement. If conciliation fails, there is no compulsory arbitration. Employees then have the right to strike, or employers to lock out.

Back of this legislation lies an interesting history of organizations. The employees were the first to combine. The employers followed suit. Then came various federations and finally, in each country, two large, close-knit, top organizations, one of employers and one of employees.

The Swedish Confederation of Trades Unions has 850,000 members, in a country of 6,000,000 people; the Norwegian federation has 300,000 out of 3,000,000. Thus the degree of unionization is far greater than ours.

However, federations include groups, such as laborers and white-collar workers, who are poorly organized or wholly unorganized in America. Swedish and Norwegian unskilled workers are practically all in the unions. There is not, as with us, a large group of unorganized, unskilled workers. In Sweden it is stated that 85 per cent of *all* industrial workers are organized.

Craft Unions Passing

Swedish and Norwegian craft unionism is giving way to the industrial type. In Sweden only about half a dozen craft unions remain, and they are not to be compared in size and strength with the industrial unions. The metal-trades union, a vertical type, has 150,000 members. The unions claim this advantage for the industrial type—only one agreement needs to be negotiated by a whole industry, and there is no constant disturbance caused by agreements expiring at different times. Employers agree. It has another advantage to the unions—increased fighting power. If they must resort to direct action, they can pull out every man in the industry.

The employers' federations are comparably strong, though they do not cover so wide a field of occupations. The Swedish Employers' Federation includes enterprises that employ only 400,000 workers. But it covers all the important manufacturing industries and all the important units in those industries. It has no less than 5,000 "associates."

Bargaining, as in most countries but not in ours, is between employers' associations and national unions. Normally, the great federations are also signatories to the agreements. The relatively small size of the countries and the relative uniformity of conditions in each make possible these agreements of national scope.

The Swedish Employers' Federation is a particularly close-knit body, and has the unusual feature of paying compensation to its associate mem-

S LABOR CONTRACTS

EDWARD J. MEHREN
Formerly Vice-President
McGraw-Hill Publishing Company

bers for time lost through strike or lockout. Its "members" are the employers' associations; its "associates," the individual company members of these associations. Associates not only pay dues, but also put up guarantee bonds, forming a "security fund" to be drawn on, if the "insurance fund" should be exhausted, in order to pay strike or lockout compensation. The "insurance fund," normally used for this purpose, is built up from the surpluses remaining from annual and entrance fees. This and other cash funds now amount to 25,000,000 Swedish crowns (roughly $6,250,000).

All Must O.K. Contracts

The constitution of the federation provides that no member association or associate may make a labor agreement without approval of the federation. An individual employer violating this rule is subject to heavy fine. Further, no lockout may be declared without the federation's approval. On the other hand, associates bind themselves to join in a lockout if declared by the federation and are subject to heavy fines if they fail to comply. Maximum penalty is 200 crowns per worker employed.

In strike or lockout, provided the latter is approved, the federation pays a minimum compensation of 1 crown (about 25 cents) per day per worker during the first three months of stoppage and 2 crowns per day per worker thereafter. However, the board has power to grant extra compensation if circumstances warrant, and, in fact, in recent years has usually done so.

For brevity's sake, I shall confine the remainder of this discussion largely to Sweden. Norwegian labor practices differ from the Swedish only in detail, however. And until a few years ago that would have been true also of Denmark. But Denmark has recently departed far from her former practice; has actually prohibited strikes and lockouts, and has set wages for a term of years by legislation.

In the Scandinavian countries (Denmark included, as to this principle) the laws make a sharp distinction between two types of labor disputes—those over the terms of agreements in course of negotiation and those over agreements already existing. The latter have the status of contracts. Strikes or lockouts over their terms are forbidden and may be legally punished. Such disputes, if they can't be settled privately, go to the Labor Court.

If question arises over the interpretation of part or all of an existing agreement, or over its application to a given situation, and should either party use direct action, it will be liable for damages to be fixed on petition of the injured party and on trial by the Labor Court. The liability lies against the individual employers or workers who stop work. But it may apply to their organizations, including even the top federations, if they are signatory to the agreement. And the liability results not only if they encourage, help organize, or support the stoppage, but even *if they fail to use all the means in their power to prevent it.*

Illegal Strikes Rare

The amount of damages is determined by the court on presentation of a claim after hearing of the facts. Among the pertinent facts may be the actions of the injured party. If he is not free from blame, the amount of damage may be reduced or dismissed entirely. Liability of individual members of unions is limited to 200 crowns.

Illegal strikes have been rare in Sweden since this law came into effect in 1928. However, they have occurred, and penalties have been collected even from individual union members. But the Labor Court's chief activity has been the adjudication of questions regarding the interpretation and application of existing agreements; such cases are constantly before it.

The court, established at the demand of the employing group, was at first unpopular with labor. Now, however, the union leaders say that it is an instrument of industrial peace and must be retained. They are not in harmony with all decisions, particularly the court's position in maintaining the employer's right to discharge whom he will. But workers have been the complainants in the majority of cases and have had well over half of the decisions in their favor.

Before 1928, damages suffered as a breach of a contract were recoverable through ordinary legal procedure. But

A.-B. Text & Bilder

Winding small coils in a Stockholm factory which makes vacuum cleaners

Swedish Travel Information Bureau, Inc.

Steelworkers in Sandviken, Sweden, live on attractive streets like this one

cases were subject to the usual delay; decisions lagged far beyond the time when they could be a factor in maintaining industrial peace. In fact, speed of decision was one reason for setting up the court. The law provides that decisions be reached as speedily as possible, preferably in one sitting.

Built for Speed

The composition of the court also makes for speed. The court has seven members, three neutral, two representing the employers, and two the employees. The three impartial members are appointed directly by the Crown, and two of these, the president and one associate, must have legal knowledge and experience. The other four are appointed by the Crown on proposal by the central employers' and labor federations.

The decisions of the Court are final and may not be appealed.

Norwegian law is in close agreement with that of Sweden regarding the jurisdiction and composition of its Labor Court, the illegality of stoppages under existing agreements, and the recovery of damages.

We turn now to the making of new agreements. Here the only element of compulsion lies in the fact that the parties must come together and negotiate. They are not compelled to agree. The right to strike or to lock out still remains.

Negotiations necessarily start between the employers' and workers' organizations in the various industries. If they fail and one of the parties decides on direct action, it must, in Sweden, give to the other party and to the government conciliator at least seven days' notice of the proposed stoppage. The conciliator, if he considers that his services may be effective, or on petition of either of the parties, may summon both to a conference. If one party complies and the other does not, the latter can be compelled to come under penalty. The imposition of penalties has rarely been necessary. The negotiators are not forced to reach an agreement. Moreover, at no stage is a strike or lockout forbidden even while conciliation negotiations are in progress.

In Norway the conciliator may intervene of his own motion, should he believe that important public interests will be affected. The parties are obliged to attend the conference he calls, penalties being provided for failure. However, as in Sweden, the parties always respond.

The chief difference in practice and a very important one is that, in Norway, the conciliator may forbid a stoppage while conciliation negotiations are under way. But this prohibition has this limitation, that, after negotiations have been under way for 10 days, either party may demand the termination of the proceedings, which then must be concluded within four days. After that, if agreement has not been reached, either party may take direct action.

The conciliators in both countries enjoy the confidence of both employers and employees, and, it was stated, are not swayed by political bias or prejudice.

In Sweden there is also special legislation for what is known as a "peace engagement". Under this law, a union may give notice to the Social Board, a government agency, that it proposes to maintain industrial peace for at least two years. The employer is then likewise bound to keep peace. Questions they cannot settle between them, go to conciliation negotiations, under chairmanship of a conciliator appointed by the Social Board. Meanwhile neither party may resort to direct action.

Should conciliation fail, the chairman when asked to do so by one of the parties requests the Social Board to appoint a board of arbitrators, who proceed to recommend terms of settlement based not on hearings but on the minutes of the proceedings and the report of the impartial chairman. If the recommendations are not acceptable to both parties, the obligation to keep the peace ceases as soon as either party notifies the other of its intention to proceed to direct action.

Satisfaction General

Now, have these procedures proved satisfactory? What do workers, employers, the public, say about them?

Generally, there is satisfaction with the methods, though this statement needs qualification as to the Norwegian employers. But the opinion is general that this system has settled a great many issues that otherwise would have led to strikes or lockouts. Public opinion seems to be that substantial justice has been done to both sides. Wage earners clearly have fared quite well. This impresses itself at every turn in both countries. The workers are alert, intelligent, well nourished, well dressed, well housed, though the number of rooms per family leaves something to be desired. In Norway, while the index of money wages in industry rose from a base of 100 in 1914 to 230 in 1937, the cost of living index rose from 100 to only 168. In Sweden the index of real wages (annual earnings) rose from 100 in 1913 to 147 in 1936.

Obviously something striking must have occurred in Norwegian and Swedish industry to have made these increases in real wages possible. The explanation lies in the growth in the volume of trade, and, more especially, in the introduction of new machinery,

(*Continued on page* 124)

When manual handling gives way to mechanical transport, the results are sure to be reflected in net profits—as in this establishment which makes grey-iron soil pipe. Here good old-fashioned hand dipping has been replaced by a completely conveyorized dipping, drying, and moving job

Faster Dipping Less Handling

WILLIAM DAVIES
Foundry Manager
Reading Foundry & Supply Co.
Reading, Pa.

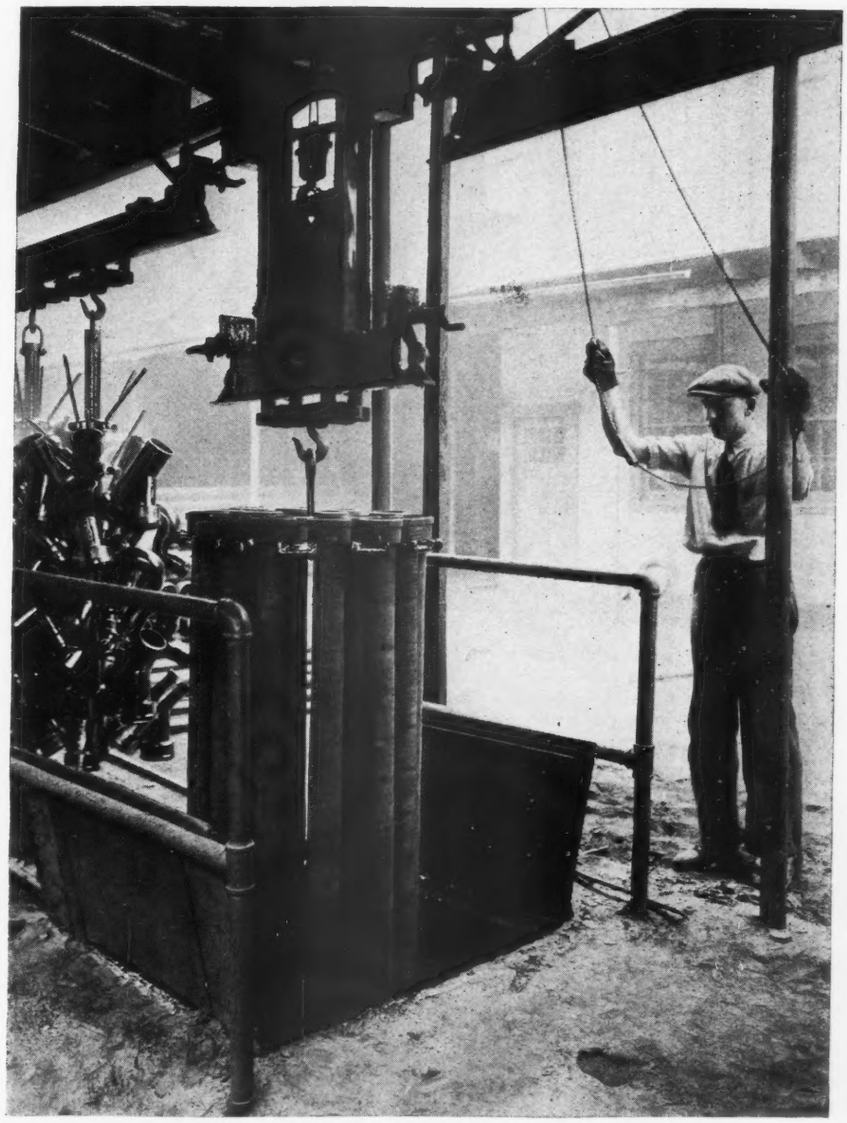
PREVIOUS METHOD: Hand dipping each pipe

NEW METHOD: All sizes automatically dipped, with allowance for proper drying. Pipe is heated to 400 deg. F. in oven. Bath is not heated

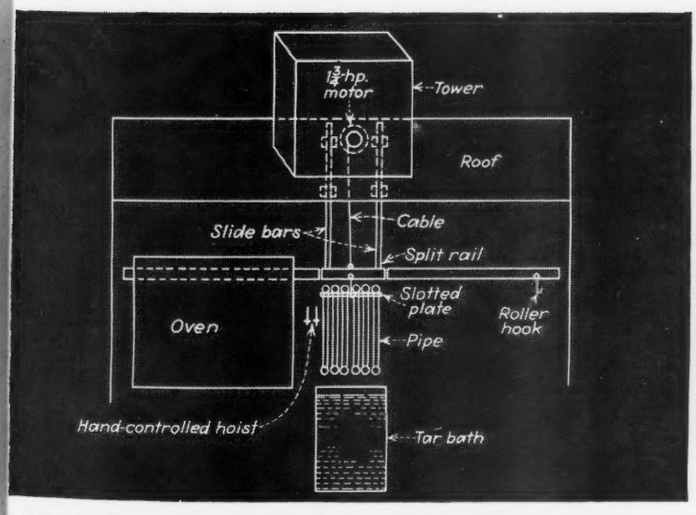
PRODUCTION: 20 tons of soil pipe in 8-hr. day. In one dip, 16 60-lb. pipes (960 lb.)

MOTOR: 1¾-hp., hand-controlled, reversible

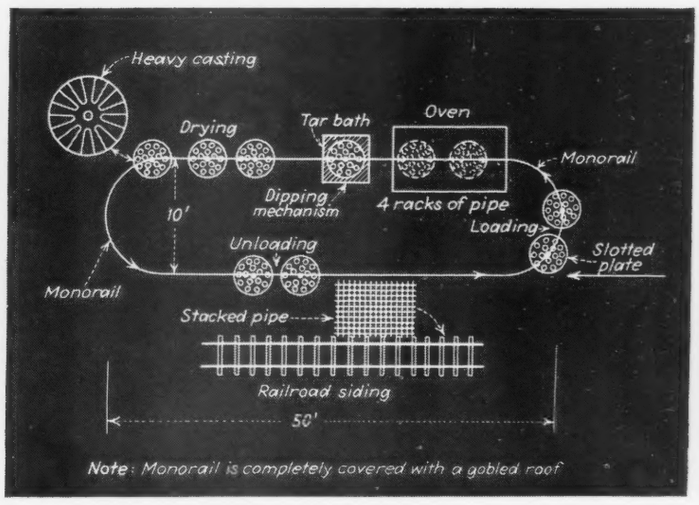
ADVANTAGES:
1. Much faster dipping
2. Less handling
3. Less labor
4. More uniform coating
5. More adherent coating
6. Lower cost per ton dipped



Sixteen 60-lb. pipes in a single dip is some improvement over back-breaking manual methods. And remember the product's now a better one at lower cost



Sketch shows how pipe loads are moved in and out of tar bath



Floor layout of conveyorized dipping and drying installation

8

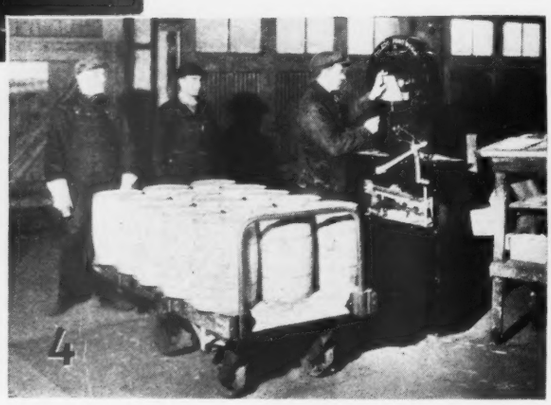
Saving Weighs

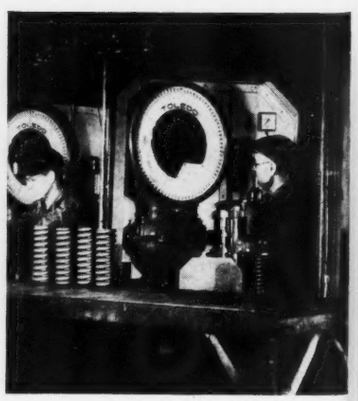
Whether it's checking incoming materials, filling cans with varnish, counting small parts, mixing batches of bread, or balancing connecting-rod assemblies, industry reports important economies from the quick, accurate weighing and counting made possible by the use of modern scales. They safeguard quality, prevent waste, save time, insure both customer and stockholder satisfaction

1. Every transaction in the stock department is in materials, which represent important money in any manufacturing enterprise. Scale counting or weighing provides the close control of materials that is so vital at this strategic point in the production cycle

2. Accurate control of parts inventories can be established through the use of counting scales like these, which find wide application wherever parts of uniform weight must be checked in or out. The saving in time over hand counting is obvious, as is the minimizing of chances for error

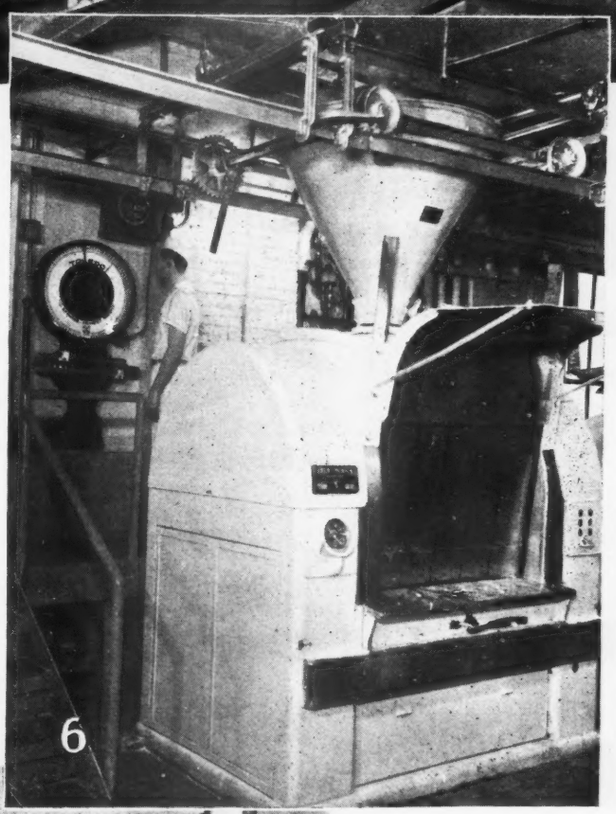
3. There are heavy-duty counting scales. Also scale of laboratory sensitivity. This one is used in regular factory production for counting tiny parts that run 62,000 to the pound





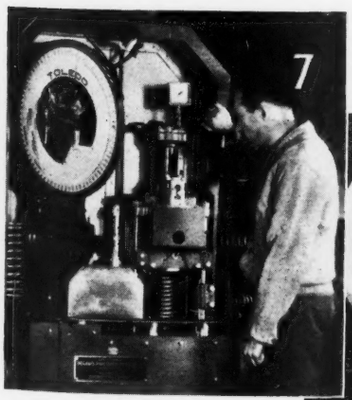
4. No incorrect readings, no transpositions, no illegible records. Printed weight records are a big step forward in accurate control of materials

5. One reason why 1938 cars function so smoothly and quietly can be traced to the use that Chrysler, to name one manufacturer, makes of scales. They are used here, for instance, to insure absolutely accurate milling of connecting rods, which are held within limits of plus or minus 2 grams. Scales show not only excess weight, but also location with respect to center of gravity



6. Many industries make use of modern weighing equipment to control batching operations. For example, in this Indianapolis bakery, where the twin objectives are quantity and quality control. Here the photocell keeps an eye on what's going on, sets in motion the forces that cut off the flow of material when the right amount has gone into the batch

7. Another sample of the wide use industry is making of modern scales. Here an automobile manufacturer tests knee-action springs. Defects are thus quickly caught, large rejections avoided. Which all means closer control of costs



8. Never a sticky spill. A varnish maker says this equipment saves 50 gal. a day. Photocell control insures filled cans, satisfied customers

500 Quick Ways to Profits

"Take a look at this Number 186, Joe, and see if it isn't the answer to that little trouble you boys have been having out in the foundry"

SCENE: XYZ Manufacturing Company. Time: November, 1938. Cast of characters: James P. Dolan, plant manager; Joseph Knowles, foundry foreman. Joe has been having a bit of trouble for the past couple of weeks, and the "chief" is passing on an item gleaned from *Factory's* "500 Quick Ways to Profits" (now being prepared for November publication).

"And, Joe," he adds, "there are 499 other cost-cutting ideas in this magazine. Take it home and look it over. I've got a hunch you'll come up with other things we can use."

"Okay, chief. But listen. How about letting me hang onto it? Looks to me like something I could use from now on."

"Just what I had in mind, Joseph. Fact is, when I heard *Factory's* editors were going to do this job, I had them reserve me enough copies so I could give one to each of you foremen. One good idea put to work in our shop will pay me back a hundred times over. And I'll bet you a good cigar we'll get least a couple dozen worth-while suggestions as a result of it."

"I won't bet. I know those sharpshooters out in the shop too well. But lemme ask a question. Sometimes it costs quite a lot of money to make these improvements, like last spring when I —"

"I know, Joe, but that was last spring. When business is like it was then, I have to practically get the board of directors' okay on any expenditure over 75 cents. But business is some better now, and when it gets this way I can always wangle a few dollars for new equipment. Just leave that part of it to me. Show me something that'll help us get our cost down. That's all I ask."

Which, in a few words, is how the men who operate plants in the manufacturing industries are going to use November *Factory*.

This issue will be a veritable handbook of cost-cutting ideas that have been sent in by readers and manufacturers, or gathered by the editors in their travels. Each item in it will describe a specific job or plan or installation or idea that reduced costs in a specific plant. Each will truly be a "quick way to profits"—not a way that applies only in a given plant or industry, but one that can be put to work "as is" or in slightly modified form in almost any other plant in the country.

PERSONNEL RECORDS OF TODAY

It's just as important these days to have modern "double entry" personnel records that can be reviewed at any time as it is to have adequate financial records available for audit by the internal revenue department. The forms shown here represent minimum paperwork for real personnel control that meets the law's requirements

EUGENE CALDWELL
General Manager, Wrought Washer Mfg. Co., Milwaukee

Thirty-Sixth in the Series of FACTORY MANAGEMENT *and* MAINTENANCE *Plant Operation Library*

PERSONNEL RECORDS OF TODAY

THE DAYS of "single-entry bookkeeping," or no bookkeeping at all, in connection with employees are over. Modern double-entry records must be established, which can be audited at any time. It is just as important these days to have high-grade personnel records, carrying with them the authority of a well-established system, as it is to have adequate financial records available for audit by the internal revenue department.

As a matter of fact, it is no exaggeration to say that personnel records that cannot be contradicted are of even greater importance, when it is realized that financial records are accepted by the internal revenue department at face value, whereas any statements in connection with personnel are apt to be suspect.

Personnel records are therefore necessary from five standpoints:

1. To justify actions that may later be challenged before the national or state labor boards.

2. To explain and justify actions with your local union or plant grievance committee.

3. To assist in proving compliance with the Walsh-Healey Act in case you have government contracts in your plant.

4. To supply accurate information for personnel control on the part of management.

5. In justice to the employees themselves.

No one can tell what action may come up before the state or national labor board at some future time. When an act of the employer is challenged two or three years after occurrence, it becomes exceedingly difficult to justify unless accurate records are maintained. Cases of contested discharge are very costly, particularly where back pay for several years must be made up.

Although questions brought up by the local union are sometimes explained more readily, particularly where the union is run by your own employees, yet the reasons and justifications are always more graciously accepted when it is possible to produce definite records of the individual in question.

Those who manufacture goods coming under the Walsh-Healey Act are familiar with the completeness with which the Labor Department is checking compliance with labor provisions. Good personnel records are invaluable when the Washington investigators visit your plant.

The importance of high-grade personnel records maintained in indisputable shape cannot be overemphasized. It should be remembered that this one set of records is now subject to periodic audit by the following organizations:

1. Your company's own certified public accountants.

2. Internal revenue department for federal income tax purposes.

3. State tax commission for state income tax purposes.

4. Insurance company carrying your compensation insurance.

5. Industrial commission's auditors in connection with the unemployment reserve.

6. Social Security Board auditors in connection with federal old age and unemployment tax.

7. National Labor Relations Board auditors.

8. Department of Labor in connection with Walsh-Healey Act.

But by far the most important reason for maintaining adequate personnel records is for information of management itself. All too many plants in the past have insisted that advancement be made on the basis of merit alone, yet no accurate records are kept to bring to light meritorious performances of employees.

Frequently wage increases are made on the basis of impressions or hunches. It is really a sorry situation when the management of even a minor league baseball team knows from official batting and fielding records far more about the relative performances of its players than do the managements of many industrial enterprises.

Much embarrassment has been caused in not a few cases after job

APPLICATION FOR EMPLOYMENT

WROUGHT WASHER MFG. CO.
MILWAUKEE, WIS.

NAME _____ (PRINT) DATE _____ 19____

ADDRESS _____ PHONE NO. _____

PERSONAL DATA

Height	Date of Birth	Home Owner	Trades Interested in
Weight	Place of Birth	Single or Married	Now Attending Night School?
Vision	Nationality	No. of Children	Subjects
Hearing	Naturalized	Other Dependents	Father's Name
Other Defects	Sex	Hobbies	Father's Occupation

Kind of work desired _____ Rate Expected _____ Do you have your own tools?

Are you expert with any particular machines or kinds of work? (State kind)

EDUCATION COMPLETED

SCHOOL	PLACE	YRS.	Grade	SPECIAL COURSE OR TRAINING
Common School				
High School				
College				
Technical				
Business				
Correspondence				
Apprenticeship				

PHYSICAL CONDITION

Are You Healthy?
Family Doctor
Address

Applicant Do Not Fill In

Doctor's Report
Examination of Vision
General Impression of Physique
Remarks

PREVIOUS EMPLOYMENT

DATE EMPLOYED	FIRM NAME	ADDRESS	KIND OF WORK	DATE LEFT	EARNINGS	REASON FOR LEAVING

EMERGENCY RECORD	NAME	ADDRESS	RELATIONSHIP
In case of Accident Notify			
Group Insurance Beneficiary			
Unemployment Savings Beneficiary			

REFERENCES

KIND	NAME	ADDRESS	TELEPHONE
Character			
Ability			
Ability			
Ability			

I declare the foregoing to be, to the best of my knowledge and belief, an accurate statement of the facts. If accepted for employment, I agree to verify any part of the above of which I now may be uncertain, reporting within 30 days any changes which should be made in this statement.

Wisconsin Unemployment Compensation Law: (Section 108.24)

"Any person who wilfully makes a false statement or representation to obtain any benefit or payment under the provisions of this chapter, either for himself or for any other person . . . , shall upon conviction be deemed guilty of a misdemeanor and be punished by a fine of not less than twenty-five dollars nor more than one hundred dollars, or by imprisonment in the county jail not longer than thirty days, or both such fine and imprisonment; and each such false statement . . . . . shall constitute a separate and distinct offense."

(Signed) _____ APPLICANT

Do Not Write Below This Line

Remarks of Interviewer

Employed: Date	Have Instructions in Safety been given?
Department	Receipt secured for Safety Rules?
Rate	Insurance Card Signed?
Employment Requisition No.	Unemployment Reserve Papers Given Out?
Other Data	Signature for Employee's Unemployment Savings Fund?

Figure 1. To get careful answers, ask only essential questions on the application for employment

analyses were completed throughout the plant to find wage rates so out of line that no explanation could be given for the variations. Each individual is unique, so it is necessary to keep a definite record of everything happening to him—all his peculiarities, and his performance record—if advantage is to be taken of qualities possessed by your own men when making promotions, or if special abilities are to be brought to your attention.

Without question these records add to the clerical work necessary, but the additional overhead must be accepted as part of the added cost of doing business under present theories of restriction and regulation of industry. When comparing the operating statement with past years, these additional expenses must be kept in mind; unless other improvements are made in the business to offset the extra expenses, net profits will naturally be lower.

The records necessary to maintain adequate personnel control seem to group themselves into the following classifications:

1. Individual employee records prepared at the time of hiring.

2. Individual employee records for regularly recurrent data.

3. Individual employee records for irregularly occurring data.

4. Individual employee records prepared at suspense or termination of employment.

5. Records of the company personnel at large.

The forms here described represent about the minimum that can be kept for personnel control and to meet the requirements of the law. Larger companies would doubtlessly expand these records considerably, segregating some of the information suggested into separate records.

It is further suggested that individual peculiarities in each company merit the design of tailor-made forms for the business in question. These can be secured almost as reasonably as stock forms purchased from the stationers, some parts of which never exactly fit the situation. Although various engineering firms specializing particularly in the design of forms render invaluable assistance in printing economy and in improvement of the form, the basic ideas involving the routine of the company must be originated by someone in the organization thoroughly familiar with all phases of the business and the coordination of the various departments.

HIRING RECORDS

THE MOST important of the individual employee records prepared at the time of hiring is the application for employment. No one should ever be hired without first filling out such an application. This form is so important that a great deal of thought should be spent on its design. All information needed to judge the applicant's fitness for work with the company should be provided for, as well as records of past history necessary to complete the company's requirements in case the applicant is accepted as an employee.

Ask Only Essential Questions

On the other hand, questions should not be asked for information not needed. Filling out application blanks is an unending task when looking for employment; to secure careful answers, the questions should be limited to essentials.

A well-designed application form (Figure 1) provides for physical characteristics and identification, as well as present status including age, birthplace, citizenship, and marital state. Education completed is useful. So is previous employment history. This includes earnings at previous employments because this information is necessary under some of the state unemployment reserve laws. In Wisconsin, for example, an employee who has earned $150 per month or more for 10 months or $35 per week for 45 weeks out of the past year is not eligible for unemployment benefits.

Space is provided for entering the name, address, and relationship of the person to be notified in case of accident as well as the group insurance beneficiary.

References of former employers as well as character references are shown, and should be carefully checked. The social security number should also be shown.

As much insight as possible into the prospective employee's likes and desires should be secured, not only to determine his adaptability for the present employment but also to assist in promotions when new openings present themselves. The kind of work wanted, his hobbies, and his attitude toward further training at night school in order to better himself, will give some clues in this direction.

Where state unemployment reserve laws or other state laws provide a penalty for supplying false information to secure employment or benefits, it is well to quote the section of the statutes on the application blank. The applicant's signature appears at the bottom of the form even though the full name is on the first line; it may become necessary later to compare signatures on checks or receipts.

All applications should be made out in the employee's own handwriting except, of course, where low-grade labor unable to write is being employed. In such cases the application blank has to be made out by someone else, and the fact noted that the applicant cannot write.

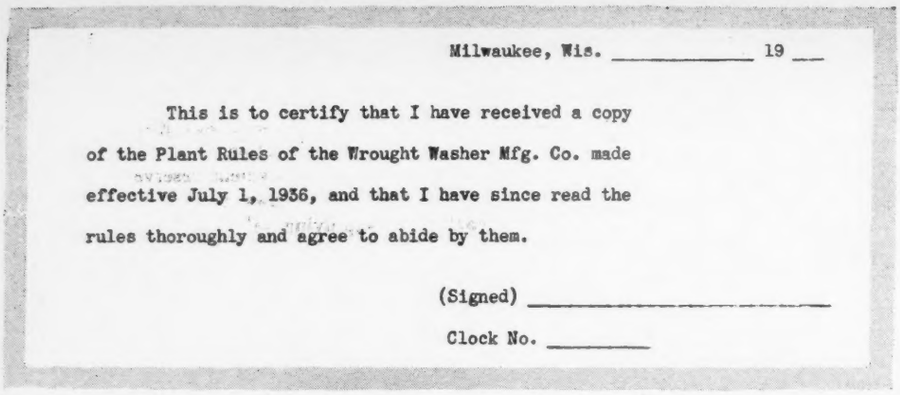
Space for Ratings

The form should also provide space for remarks of the interviewer, including ratings of the applicant which he could not reasonably be expected to give himself, such as general appearance, neatness, physique, aggressiveness, and personality.

When the application form is being designed, serious consideration should be given to the inclusion or exclusion of another factor. Forms now in use by some companies ask for union affiliations to be shown. Although this is not specifically excluded from application forms by law as is the question of the applicant's religion in some states, a recording of union affiliations on the form seems highly undesirable.

The Wagner Act states in effect that *hiring* as well as firing of employees shall not be influenced by labor union membership. Of course it does not necessarily follow that the statement of union membership on the application form influences an employer in selecting new employees. However, the fact that the employer has been put on notice as to the union affiliation of the applicant may later be used against the employer; it may be contended that the decision concerning hiring rested entirely upon the answer to the question on the application form. Consequently it is believed to be the better part of good judgment to omit questions of this nature from the form.

The new labor psychology has created the situation wherein certain definite responsibilities accompany the hiring of every new employee. Whereas the employer has no responsibility toward an applicant, the em-



Milwaukee, Wis. _____ 19 ___

This is to certify that I have received a copy of the Plant Rules of the Wrought Washer Mfg. Co. made effective July 1, 1936, and that I have since read the rules thoroughly and agree to abide by them.

(Signed) _____

Clock No. _____

Figure 2. Proof that employees have read safety rules can be very useful

ployee, once he is on the payroll, is not so easily disposed of. Seniority clauses in most union contracts restrict advancement of superior employees, and the new labor attitude prevents the free discharge to some extent of incompetent employees. In reality the Wagner Act has placed only one restriction on the discharge of employees—discharge cannot be because of union activity. The employer still has the power and right to discharge for any cause whatever, or for caprice, or for no cause at all —so long as the discharge is not because of union activity.

The Right to Discharge

Practically, however, the ability to discharge has been restricted to a much greater extent than this because of the attitude of the National Labor Relations Board, which seems to interpret any given set of facts related to discharge as because of union activity. There has been a further restriction in Wisconsin; if discharge is for any other cause than misconduct on the part of the employee, he must be paid unemployment benefits. The union claim that the employer no longer has the right to discharge is therefore about 50 per cent true.

Since, through seniority and inability to discharge, an employee more or less attaches himself to an organization when once hired, greater attention must be paid to selecting the right applicants. If the wrong type is chosen in the first place, he is difficult to lose even during periods of extended layoffs, for there is little chance of another employer hiring him, and when business picks up again, seniority dictates that he be brought back. The employer finds himself much in the same position as the young man who, at the beginning of the dance, picks out a girl so homely no one will tag him during the entire evening.

With these thoughts in mind many managers insist that before an applicant is accepted he must be interviewed by a major executive to determine attitudes.

In other words, after it has been determined that the applicant is physically fitted and sufficiently educated and experienced for the work at hand, he must further pass the test of having the right mental attitude. Generally the management has no objection to a union in itself, but it has a right to protect itself against trouble makers and the radical element, whose thinking runs off at a tangent, as well as those who are always an easy prey of the unscrupulous type of labor agitator.

Consequently the application blank should be designed to record as much about the prospective employee's fitness for the work as can be determined through a personal interview by a top executive.

Some firms desire to transfer the information on the application form to an employee's data sheet where it can be typed in neat fashion. However, this is unnecessary if the application blank itself is filed with the employee's papers. Moreover, the retyped employee's data sheet does not contain a copy of the employee's signature, unless, of course, the employee is required to sign this again. In case the retyped data sheet is used, this can be combined with the irregularly recurring information described later.

A form for the physical examination is also one of the personnel control records prepared at the time of hiring. Obviously this includes all the items it is desired to have the doctor check. No items should be omitted that might later be useful in contesting a claim for compensation. In other words the examination should disclose the physical condition of the new employee at the time of hiring, which would prevent his claiming compensation later for hernia contracted before his connection with the company. If statements of the employee as to his previous health are required, provision should be made for the employee to sign the medical examination.

Certain other special records forming part of the personnel control records made out at the time of hiring may require the employee's signature, such as authorization for deduction for group life insurance. Various companies which have codified their safety rules hand out a booklet of the rules at the time of employment, and three days after require a form (Figure 2) stating the employee has read the rules and agrees to abide by them. These signed forms are kept on file, forming evidence difficult to dispute, in case of an accident, that the employee was notified of the rule.

REGULARLY RECURRENT DATA

DATA falling within the group of regular recurring information can usually be placed on a single sheet known as the employee's ledger sheet or earnings record (Figure 3). In addition to the employee's name and clock number, the hours worked, rate, tonnage or pieces if on a piecework rate, total amount earned, deductions for federal retirement tax, group insurance and other deductions, and net pay are entered each week.

An accumulated total should also be kept of the employee's earnings counting toward old age benefits, although it may be more convenient to record this once a year on the irregularly occurring information sheet described later.

Most of the unemployment reserve laws are based upon calendar weeks. This has revised many companies' payroll procedures, for it is almost necessary now to figure earnings weekly even though pay days are every two weeks. No more clerical work is involved for weekly pay days except the work of making out the checks themselves.

The employee's earnings sheet lends itself peculiarly well to machine bookkeeping. By means of a modern bookkeeping machine, the payroll check, employee's ledger sheet, stub explaining the deductions to the employee, and a journal sheet of the entire payroll (the latter falling within the class of records applying to the company as a whole) can be prepared in one operation.

The same can be accomplished on tabulating equipment, where the time is accumulated on various job tickets for which a tabulating card is

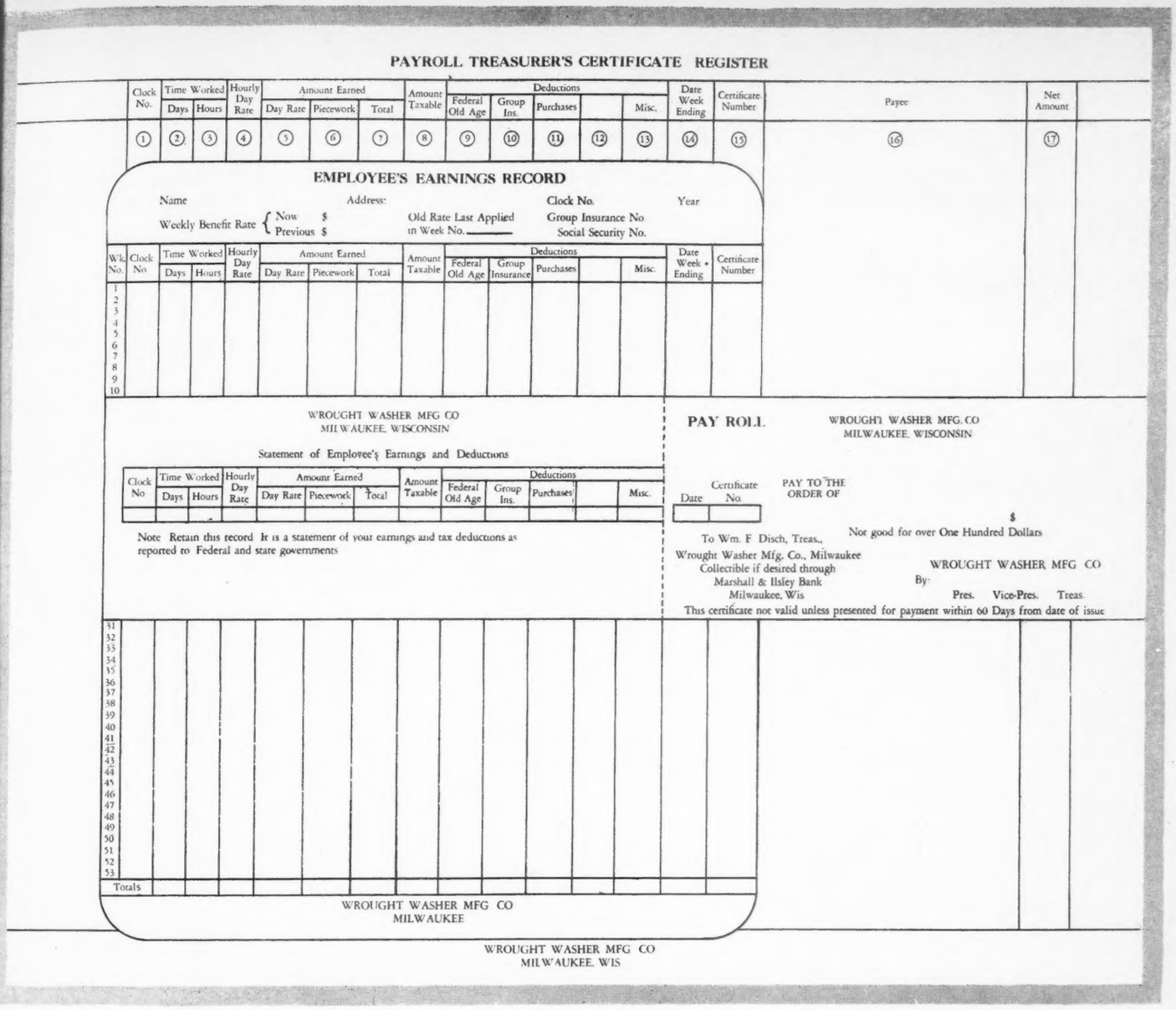


Figure 3. Layout for preparing payroll on bookkeeping machine

punched. For payroll preparation either by bookkeeping or by tabulating machine, it is necessary to go to weekly pay days because checks are made out at the same time the record is made.

The forms illustrated in Figure 3 show the layout for preparing the payroll on a bookkeeping machine. The larger sheet is the journal of payroll subsequently described. The next smaller sheet is the employee's earnings record which is arranged for an entire year's data on one side. The reverse side can be used for the following year if desired, although a tumble form (one which turns over end for end) cannot be used in view of difficulties with the guide numbers to the left. In other words, the top of the reverse side of the form must be the top of the side shown. The small numbers for each line at the left serve a dual purpose, recording the week number as designated by the industrial commission for unemployment reserve and guiding the operator in lining up the form to print on the next line.

Copying the clock number from the journal sheet to the employee's earnings record provides a check against posting earnings to the wrong employee's sheet. When posting has been done correctly, all clock numbers down the left-hand column will be the same for any given employee's earnings record.

At the end of the year columns 2, 3, 5, 6, 7, 8, 9, 10, 11, 12, and 13 of the employee's earnings record must be totaled on an adding machine, and the totals recorded in the space provided.

No attempt should be made to combine the regularly recurring information on the same record with the irregularly occurring information (described below), or with the data sheet prepared from the application blank, for the reason that the regularly recurring information will require a new sheet approximately every year. If the two (or three) are combined, then it will be necessary laboriously to copy all the fixed information over again each year. Moreover, the regularly recurring information is adaptable to machine bookkeeping whereas the irregularly occurring information is best recorded by pen.

The employee's ledger represents the minimum personnel record permitted by law. The Social Security Act requires that an accurate account be kept of each employee's earnings in such shape that it can be audited at any time. The same provision is part of most of the state unemployment laws. For federal and state income tax purposes an accurate record must be kept of total yearly earnings.

IRREGULARLY OCCURRING DATA

THE RECORD of irregularly occurring information is the most important of any for purposes of personnel control, because in this record special abilities and efforts should show up, also attitudes, and all the other qualities and factors tending to make the individual a poor or a valuable employee of the company. A well-designed form for this information (Figure 4) provides space for rate changes and a continuous log.

Space is provided for the employee's safety record, showing the number of trips per month to the hospital for minor injuries as well as complete details of any doctor cases. The space for health record shows the absences from work due to sickness or any occupational diseases contracted at work.

A portion of the form is devoted to recording periodic ratings. The rating of individuals should not be confused with job rating, which is done principally to make comparisons of rates between companies. Job rating is an analysis and evaluation of the work to be done without considering who is to do it, whereas individual rating is an evaluation of the individual's skill and aptitude in the work being done.

Job ratings are very valuable; in general wage rates, or at least rate ranges, should be based almost entirely on the job without regard to the individual.

Ratings for Ability

Periodic ability ratings should be made preferably every six months and by more than one person. The average of the ratings should be recorded on the data sheet for the employee.

For those employees who work on incentive rates, a gauge of efficiency is shown by recording the average earnings per hour. Space is provided for recording the average earnings per hour preferably every six months. If the policy of the company is to guarantee a minimum hourly rate or to pay the employee's hourly rate when incentive earnings are below that rate, then it is well to record also the number of hours of work when earnings would have been below the day rate.

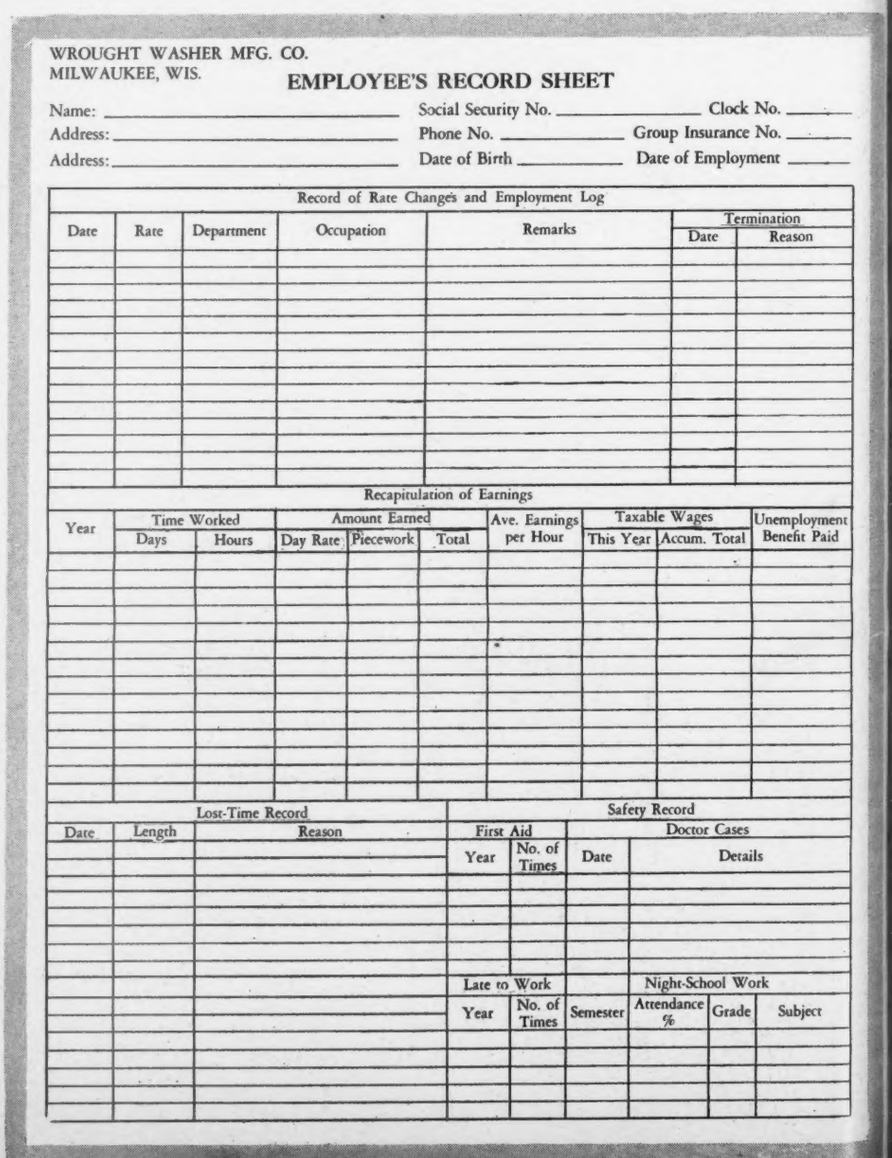
Since the employee's earning statement can hardly be made large enough to accommodate more than a year's data and must then be replaced with a new sheet, it is a good plan to provide space with the irregularly occurring data for yearly totals of earnings, particularly since these totals must be obtained anyway for reporting to state and federal income tax departments.

In addition, an accumulated total of taxable wages on which social security taxes have been paid may be kept in the event information is desired at any time by the employee or in case it is necessary to check with the Social Security Board's records.

Additional space is provided for recording all grievances brought up either by the employee or by others in connection with the employee in question. Reprimands and all disciplinary action are recorded. Several companies have gone to the extent of requiring all reprimands to be made in writing, pointing out the portion of the company's rules or labor policy violated. This is hardly necessary in a small company. The important point is to see that the information reaches the personnel department for entering on the employee's record.

In order to cite an employee for infraction of a specific section of the company's rules or labor policy, it is essential to have the rules or the policy in writing. This is desirable whether the company is small or large. In drawing up a written labor policy or set of rules, care should be taken not to make it negative in aspect—that is, the rules should not state, "Do *not* do this or that."

At this point it would be advisable to call attention to the fact that the employee's record should not be a collection of violations and inefficiencies of the worker. His successes and unusual performances should also be recorded, and in fact should be given even more prominence than his failures.



WROUGHT WASHER MFG. CO.
MILWAUKEE, WIS.

EMPLOYEE'S RECORD SHEET

Name: _____ Social Security No. _____ Clock No. _____
Address: _____ Phone No. _____ Group Insurance No. _____
Address: _____ Date of Birth _____ Date of Employment _____

Record of Rate Changes and Employment Log

Date	Rate	Department	Occupation	Remarks	Termination	
					Date	Reason

Recapitulation of Earnings

Year	Time Worked		Amount Earned			Ave. Earnings per Hour	Taxable Wages		Unemployment Benefit Paid
	Days	Hours	Day Rate	Piecework	Total		This Year	Accum. Total	

Lost-Time Record

Date	Length	Reason

Safety Record

First Aid		Doctor Cases	
Year	No. of Times	Date	Details

Late to Work		Night-School Work			
Year	No. of Times	Semester	Attendance %	Grade	Subject

Figure 4. A well-designed employees' record sheet with room on the back for periodic ability ratings

Figure 5. Discharge blank allows employee to state his version of the case

DISCHARGE BLANK

WROUGHT WASHER MFG. CO.
MILWAUKEE, WIS.

Date _____ 19__

TO PAYMASTER:

Name _____ Last Day Worked _____ Clock No. _____

Have tools been returned? _____ Comments: _____

☐ Would Rehire
☐ Would Not Rehire

REASON FOR TERMINATION

Voluntary:	Discharged:	Other:
☐ Sickness	☐ Misconduct	☐ Fire, Act of God, etc.
☐ Family	☐ Incompetence	☐ Refused suitable work
☐ Better Job	☐ Work Unsatisfactory	☐ Failed to report
☐ Not Enough Pay	☐ Student—End of Vacation	☐ Insufficient Work
☐ Dissatisfied	☐ Student—End of Course	☐ Other
☐ Other	☐ Other	

Give detailed statement of termination: _____

FOREMAN ASSISTANT SUPT.—DEPT. HEAD SUPERINTENDENT—OFFICE MGR.

NOTICE TO EMPLOYEE: — Statements made on this form may affect your eligibility to benefits for Unemployment Compensation. If you do not agree with the Company statement made above, you should record below your version of why employment was terminated. If further information is desired regarding your rights, a copy of the Wisconsin Unemployment Reserve Law is on file in the Company's Office.

I hereby acknowledge receipt of final wages due and certify that the foregoing is a true statement of the reason my employment was terminated. If I have made no explanation of my own, I accept the Company's statement of the cause of termination of employment.

Signed _____
EMPLOYEE

(For Office Records)

Replaced by _____ Clock No. _____ Liability Terminates _____ 19__

A few companies have adopted the attitude that only situations requiring reprimands should be recorded on the reasoning that it is well to build up a case against every employee in order to substantiate dismissal later in the event that it is desired. This plan is shortsighted in view of the fact that, when a previously satisfactory employee changes his attitude regarding the company, he generally commits several infractions of the rules, since he no longer is acting wholly in the interest of the company.

Moreover, every employee is entitled to one or more warnings (each of which should be recorded) before actual dismissal. The records will be hardly worth keeping if they are not just as serviceable in bringing efficient and desirable employees into the limelight for advancement as they are in substantiating dismissal of antagonistic employees.

Ample space is provided on the employee's record sheet under "Miscellaneous Remarks" for recording any information that causes the employee to stand out in any way from his fellows. For example, if the employee objects to parking his car on the parking lot provided and insists upon leaving it on the street, that should be entered. When an employee refuses to wear glasses after a plant eye survey shows he needs them, the facts should be recorded. If the employee makes a suggestion, good or bad, in connection with his work or the company's business, that is useful in the record.

This record of irregularly occurring information, which might be called the employee's ledger sheet, should be present whenever wage increases are being considered or possibilities for an opening in the plant, as well as any other factor concerning the worker's employment. Needless to say, the ledger sheet should not be destroyed when the employee's service terminates, although it should be removed from the active file. The data will be needed if references are required by other companies or if the worker is re-employed later. Disputes, particularly concerning termination, sometimes arise several years afterward.

EMPLOYEE'S RECORD SHEET

Name _____ Address _____ Clock No. _____

Efficiency Ratings

		Date	Date
Physical	Bearing		Leadership: Enthusiasm
	Physique		Self Reliance
	Vitality		Can Handle Public
	Voice		Can Handle Employees
Habits	Neat Appearance		Gets Co-operation
	Clean		Gives Co-operation
	Orderly		Working: Initiative
Disposition	Cheerful		Ingenuity
	Patient		Observing
	Impulsive		Perseverance
	Nervous		Common Sense
	Stubborn		Speed
	Argumentative		Follow-Thru-Habit
	Antagonistic		Neat Work
	Sociable		Accurate
	Sympathetic		Adaptable
	Dependable		Industrious
Mental	General Knowledge		Personal: Personality
	Knowledge of Job		Courtesy
	Trade Ability		Tact
	Logical		Conceit
	Clear Expression		Integrity
	Quick to Arrive at Conclusion		Do You Recommend?
	Alert		
	Concentration		
	Ambitious		Rated by:
	Practical		

Successes and Failures of Note

Date	Action Taken	Details

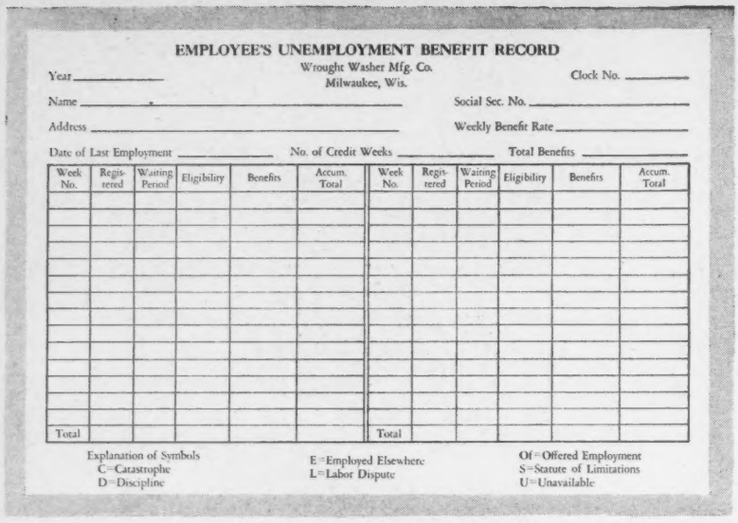
Miscellaneous Remarks

Code:
A — Award Made
B — Bonus
C — Commended
M — Meritorious Service
G — Grievance by employee
K — Grievance about employee
R — Reprimanded
S — Suggestion made by employee

Contributory Forms

There are many contributory forms necessary to get the information into the personnel department for recording. These are made out where the information originates, and are peculiar to each plant, depending upon the particular organization involved. In smaller organizations the number of these contributory forms is held down to the minimum.

Upon termination of the employment or its postponement by layoff, the fact together with the reason is recorded under the employment log described first under this section. However, the employee enters a different status when he is discharged or laid off and the details of that status are best recorded on a separate set of forms.



EMPLOYEE'S UNEMPLOYMENT BENEFIT RECORD

Wrought Washer Mfg. Co.
Milwaukee, Wis.

Year _____ Clock No. _____

Name _____ Social Sec. No. _____

Address _____ Weekly Benefit Rate _____

Date of Last Employment _____ No. of Credit Weeks _____ Total Benefits _____

Week No.	Registered	Waiting Period	Eligibility	Benefits	Accum. Total	Week No.	Registered	Waiting Period	Eligibility	Benefits	Accum. Total
Total						Total					

Explanation of Symbols
C=Catastrophe
D=Discipline
E=Employed Elsewhere
L=Labor Dispute
Of=Offered Employment
S=Statute of Limitations
U=Unavailable

Figure 6 shows lost-time record required by law in Wisconsin
Figure 7 contains space for needed unemployment benefit data

LOST-TIME RECORD

WROUGHT WASHER MFG. CO.
MILWAUKEE, WIS.

Employee _____ Clock No. _____

Period Absent from _____ 19__ to _____ 19__

Reason for Absence:

- ☐ Sickness
- ☐ Accident at Plant
- ☐ Accident Outside Plant
- ☐ Time Off at My Request
- ☐ Otherwise Unable to Work (Explain)
- ☐ Other Reason (Explain Below)

Explanation: _____

I hereby certify that work was available and offered to me and that I did not work because of the reasons above stated.

(Signed) _____
EMPLOYEE

TERMINATION RECORDS

SINCE the status of an employee for unemployment benefits is established at the date of termination, it has been found desirable to segregate this information from the other forms and make it out at the time of the exit. In other words, instead of keeping a running record of each employee's status as it would be *if* he were laid off, the work can be simplified by preparing only cases of actual termination.

The first essential record for terminations is an adequate discharge blank (Figure 5). This states in detail the reason for the termination and is signed by the foreman and superintendent as well as any others having direct supervision over the employee. The form states definitely whether the foreman would rehire. The employee is required to read the discharge blank and sign it before receiving his final pay, space being provided for the employee's version in case it differs with the foreman's and superintendent's. The discharge blank should be carefully worded so as to prevent the employee from giving a different version for purposes of collecting benefits, or for any other reason.

In Wisconsin a lost-time record (Figure 6) is necessary in view of the industrial commission's ruling, in administration of the unemployment reserve law, that all persons earning less than their benefit rate must be reported each week.

Since benefit rates are approximately half of normal earnings, an employee goes on the report if he is absent 2½ days during the week. Consequently the lost-time record is not used for absences of two days or less. (Company rules could well provide that absences of even one day must be preceded by notification, usually a telephone call). But after two days' absence in the same week the employee's time card is removed from the rack, and he is required to go to the timekeeping department and sign a lost-time record giving the reason for his absence. This supports the statement on the report to the commission showing ineligibility.

Except for those terminations where unemployment benefits are not in question, an employee's unemployment benefit record (Figure 7) is made at the time of termination. In addition to the name, address, and social security number of the employee, this sheet shows date laid off, weekly benefit rate, total number of weeks to his credit, and total benefits payable. Space is provided for recording each week when an employee registers at the public employment office (required to become eligible for benefits), the week constituting the waiting period, whether other employment has been secured, and actual payment of benefits.

COMPANY RECORDS

IN ORDER to control personnel it is necessary to keep certain records and statistics for the entire company. The first of such company records is the payroll journal (see Figure 3) or list of employees with the payments to them each pay day. When the payroll is prepared on a bookkeeping machine or a tabulating machine, this journal is prepared automatically. In small companies, perhaps, the journal of the payroll is not necessary, provided the time cards are kept sorted into weeks.

The next form required for the company as a whole is a work sheet for determining the status of the company's reserve fund, although this would not be necessary in states not having merit ratings in their unemployment reserve law.

The work sheet accumulates the total payroll by months, and records the contribution to the reserve account each month as well as the contribution to the administration fund. Monthly contributions are totaled into the accumulated reserve, and space is provided for deducting benefits paid. A running total of the payroll for the past 12 months is kept by adding in the current month and deducting the same month a year ago.

The per cent of this 12 months' payroll necessary for the first reduction in contribution rate is shown, and the difference between this figure and the actual total reserve recorded. This latter amount represents the contribution that would have to be made in order to reduce the contribution rate. The number of defined employees should also be shown. In Wisconsin this means deducting employees who have earned $150 per month during 10 months out of the past 12 or $35 per week for 45 weeks out of the past 52, in addition to students and certain others.

Certain statistics should be kept in readily available form, such as days and hours the plant operates each week, as well as the same for each department. The number of men working in each department and in the plant as a whole is also a good figure to keep.

Total taxes payable on the part of the company for social security should be accrued each month until the semi-annual tax return is due. Also the employee's tax held in trust should be accumulated. However, these two items can well be kept by opening up ledger accounts in the general ledger for the purpose.

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Foremen Should Know

JOHN RICHELSEN
Personnel Director
Vanadium Corporation of America
Niagara Falls, N. Y.

. . . impossible to unscramble eggs once they are in the omelet

One of the things that foremen should know, and an easy one for you to explain, is the relationship of jobs to machines

IT'S NOT to be wondered at if wage earners are afraid of what new machinery will do to them. No man wants to be thrown out of his job. Every decent citizen shrinks from the thought of dependency.

Certainly machines throw men out of work. The average wage earner may have little education, but he is not so dumb as not to know that. And naturally he is made restless because of his fears about machinery and the injustice it seems to work out for him and his friends.

That is why foremen should have a clear picture of this relationship of man to machines. Let's not mix up our ideas, because it's impossible to unscramble eggs once they are in the omelet. We are not discussing the distribution of wealth and social justice, but just the question, "Does the machine throw men out of work?"

Of course it does. That's what the machine is for. It does man's work for him. It was curtains for thousands of farm slaves when the reaper came on the field. It was good-night for most of the horse-and-buggy business when the automobile started chugging down the roads.

We're not ducking the facts. But so far this has been a lopsided statement of the truth.

For *this* is the truth: *Machines also create jobs.* Machines create jobs faster than population increases. There were something like a million people employed in the horse-and-buggy business in 1900. The automobile, a product of the machine, threw them out of work. But today the automobile is making work directly or indirectly for close to 5 million people. In 1870, 324 out of every 1,000 people had occupations. The country has grown tremendously since then, but jobs have grown even faster, for in 1900 the number of people who had occupations had increased to 398 in every 1,000—and this in spite of a decline in child labor.

How Jobs Grew

According to the Fifteenth Census, population in 1870 was 38,558,371. Persons engaged in gainful occupations numbered 12,505,923—or 32.4 per cent. In 1900 the population was 75,994,575; persons working numbered 29,073,233—or 38.3 per cent. In 1930 the population was 122,775,046; there were 48,829,920 gainfully employed—or 39.8 per cent.

That is the true picture of the relation of machinery to employment. So if the wage earner's reactions to machinery create a state of mind on which the kibitzers can butt in to the harm of industry, whose fault is it? Among those who must take the blame are the foremen, for they should know the facts of industry and be able to pass them on.

Machinery makes more jobs for men, but compels changes in jobs. While the changes are being made, the wage earner has to be protected. But that's another subject, and we agreed to stick to one here.

Anyway you look at it, American wage earners ought not to be left in doubt and fear just because foremen and personnel directors and other factory executives are either inexcusably ignorant of the facts, or else neglect the social obligation to inform their less fortunate fellows. The truth about the machine lets a ray of light and hope and happiness for the future shine in upon America's industrial scene. Foremen should know the truth about the machine, and how to pass it on to others.

Job-Order Plants, Too, CAN BUDGET

The oft-repeated alibis will not stand up. Budgeting in job-order plants does not differ in principle from budgeting in mass-production industries. The difference is in the method

A. A. HADDEN
McClure, Hadden & Swisher
Chicago

ONE of the alibis most frequently heard for not having a budget in a job-order manufacturing plant is that, by its very nature, orders cannot be anticipated and therefore cannot be budgeted. Let us examine this attitude in the light of cold facts.

In the first place: "What *is* a job-order plant?"

Presumably it is a business in which the products are made according to the customer's specifications, and in which the specifications are not known until the order is received. The argument against budgeting, then, is that, if you do not know what you are going to make, you cannot predict either the volume or the cost of production; and consequently you cannot ask those who are responsible for these costs to commit themselves in advance as to what they will spend.

Different in Method Only

This would seem to be unanswerable if you were thinking of a budget in terms of standard products. But the difference in job-order budgetary procedure is one of method rather than of principle.

Obviously we cannot say in a job-order plant that we are going to produce one million of x products and that it should cost y dollars to produce them. We must proceed painstakingly—one step at a time.

Let us ask first: "What are the known facts and what are the unknown facts?"

We know we have facilities to produce goods of a certain character. If we are in a made-to-order business such as materials handling equipment, we are going to produce the thing we know how to make—cranes, trucks, hoists, conveyors. Or, if we are in the printing business, we are going to produce printing, which in turn is often limited to certain kinds of printing. In neither case are we going to make gray-iron castings. We are therefore going to do certain things with which we already are familiar, which we know how to make, and for which we have the facilities to produce. To that extent, therefore, we are not dealing with unknown factors. We can therefore predict that, under certain conditions, certain results can be obtained.

The application of a budgetary procedure in a job-order plant, then, becomes a problem of determining what should be the cost, or result, under a given range of circumstances, of which, because we are offering our facilities and our experience to the purchaser, we presumably have specialized knowledge.

The only unknown facts are the relative quantities of goods within the range of our facilities that will be sold. The problem, then, is to relate the sales forecast to the production budget.

This brings up the question of the budget period. It may have to be shorter than that used in a standard-product business. Even this may depend upon the individual company, but the more common practice is to budget for one to three months.

The sales forecast is developed from an examination of the probable requirements of individual customers and prospects, together with the orders now on hand for delivery during the period under consideration. Admittedly, unforeseen conditions may change the picture. Nevertheless, it is usually possible to establish with reasonable accuracy what may be expected. Even a mass-production business cannot predict with entire accuracy. Production schedules often have to be revised upward or downward. Or the proportion of different products in the schedule may have to be changed, thereby necessitating a revision of the budget. So why should a job-order business demand complete accuracy in its forecast?

The one essential in either type of business is to be able to control the situation under any circumstances by having, first, a plan and, second, the necessary facts upon which to make intelligent revisions of the plan, as circumstances may require.

A few years ago a company engaged in a job-order business with plants scattered over the country decided to establish a budgetary control. One of the problems immediately encountered was the apparent impossibility, because of the lack of the necessary figures, of predetermining unit costs and thereby differentiating between a sales profit and a manufacturing gain. (By a manufacturing gain or loss is meant a gain or loss caused by an actual manufacturing cost under or over the budgeted or standard cost. A sales profit or loss is that resulting from a sales price which is greater or less than the standard manufacturing cost, after allowing for selling and administrative expense.)

Unpredictable Variations

Labor was already being measured by production standards, but unpredictable variations in the price and quality of raw materials affected both material and labor costs in actual production. Fluctuations of volume from month to month caused fluctuations in plant profits. A standard rate had been used for some time past to cost out burden, but there was no apparent cause for variations in absorbed burden, even in periods of similar volume. An additional complication arose through the fact that rarely did any plant have orders on hand for more than the next two or three days. As a result of all this, the effect of prices on profits could not be determined.

The first attack on this problem was an analysis of the variation in direct productive hours caused by variations in the specifications of the finished products. From a study of the direct hours required for individual jobs over a period of several

months, charts and tables were developed which accurately reflected the variations in direct labor caused by variations in the specifications of the products.

By applying the hours from these tables to both estimates and production schedules, it was then possible to say to a given plant: "We are putting into your production a predetermined number of direct labor hours." This was the first step in the establishment of a production budget. By establishing standards for the base rates at which the direct labor was to be paid, direct productive costs could be budgeted in advance of individual orders, even though a detailed schedule could not be made to cover a period of more than two or three days. Standard material costs were set up, including standard waste and spoilage allowances.

The next step was to ascertain the amount of indirect labor required at varying levels of production. It was found that indirect labor did not vary as a fixed percentage of direct labor. The percentage figure decreased, and when charted produced a flat curve rather than a 45-deg. line.

Burden expenses were then budgeted according to the activity that determined their variation. Certain expenses did not vary at all with volume; others, such as heat, light, and power, required individual analysis.

Placing Responsibility

After this study had been made, it was possible to establish the cost at which any plant should operate under any variation of product or volume. Net result was that management could definitely fix the responsibility of the plant managers for manufacturing gains or losses. They had a production budget.

It is always desirable to set up budgetary accounts according to responsibility in the first instance. Elaborate budgets have been prepared in which productive departments were meticulously charged with their share of expenses they could not possibly control, while the responsible source of these expenses was lost in the distribution.

Each person who controls any expenditure of company funds, whether in the form of labor, materials, or money, should be responsible for the preparation of that portion of the budget that pertains to his activities.

This principle has two advantages. It forestalls alibis, and it stimulates thinking. A man who will have glib explanations, *after* an unnecessary expense has been entailed, will hesitate to plan the same expenditure *before* it has been incurred, if he knows that this expense will be scrutinized as part of the budget.

Another byproduct of the budget is the placing of responsibility for losses due to lack of volume where it belongs—perhaps in the sales or executive departments. Surely the manufacturing department can do no more than to make the goods for which it receives orders at a direct cost not greater than that predetermined by the budget, and at a burden cost not in excess of that which has been predetermined for a given volume of production.

There will then be only two reasons for a manufacturing loss—failure to perform according to budgeted costs, or lack of volume.

In the first case it is a failure of the manufacturing division, except in certain instances such as changes in prices of raw materials. In the second case it may be due to any number of causes, none of which is within the control of the plant management. A clear separation of these causes and results will be helpful in promoting a better understanding between all departments.

HEISER TAKES NAM POST

Dr. Victor G. Heiser

APPOINTMENT of Dr. Victor G. Heiser, former Director of Health of the Philippine Islands and author of "An American Doctor's Odyssey," as Research Director of the National Association of Manufacturers' Committee on Healthful Working Conditions, was announced in August, by C. M. Chester, Chairman of NAM's Executive Committee and Chairman of General Foods.

The Committee was organized recently with a view to assisting American industry in the field of industrial health. It was created with the hope of bringing about a wider extension of medical service for American wage earners.

Dr. Heiser recently completed a European tour in which he made a special study of industrial health conditions and methods there.

"Despite the widespread action to reduce employee injury and illness, preliminary studies show that the smaller American industrial units have fallen behind in giving such care," he said in accepting his new post. "Authoritative surveys show that approximately 80 to 90 per cent of the large industries give excellent medical care and health supervision to their men, but the smaller units with 300 employees or less have not felt able to give such care although they account for one-quarter of the industrial population in the United States.

"With the hope of being of service the National Association of Manufacturers through its Committee on Healthful Working Conditions is studying various plans that have been proposed to ameliorate this serious situation. . .

"It was recently stated by Dr. Newquist of the American College of Surgeons that in 1936 a survey of a cross-section of employees showed that 352,591 workers lost 208,648 days of work due to industrial injury, or approximately one-half day per man per year.

"The American College of Surgeons, which has many hundreds of doctor members engaged in work similar to that being undertaken by the NAM, has offered the Committee its fullest cooperation."

Dramatized

Bright red "pork barrels" feature this company's war on waste, driving home to all its employees the knowledge that the tools and materials they waste cost real money

EMPLOYEES seldom think of the tools they use and the materials they handle in terms of what they cost the company. That's why we started our waste-saving campaign.

In this campaign we wanted to impress on all employees the cost elements in the plant's activities, to point out the more common causes of waste, and to solicit everyone's help in eliminating this waste.

For several years it has been our practice to stage special drives of this sort to throw the spotlight on different phases of plant activity. Such things as scrap, safety, use of materials, and size of gates and sprues have been subjects of concentrated attention. It must not be assumed that these subjects receive no emphasis in the day-to-day routine of management, but, after all, things done constantly tend to become routine, hence too little thought is devoted to them.

It is a daily practice in our plant to total the value of non-productive materials charged to each foreman, and send him a copy. After a time this becomes merely a piece of paper to be filed, and it takes a spotlight thrown at intervals at some of the more important items in the list to renew his interest in it, and cause him to check the charges made against his department.

Attention and interest must be aroused at the start and held throughout a campaign of this sort. Letters posted on all bulletin boards announced the start of the campaign on a particular day. When the doors opened for work that morning, signs were ready and up. A large one at the entrance carried the one word "Waste."

Willie Waste, the Lifer

Just inside the building another sign announced—"Waste-Saving Campaign in Progress." Along the routes to the several departments, were signs with different messages, such as, "Our *waste* line needs reducing" and "This way to the foundry—is this the way to a wasteful department?"

The campaign was dramatized by a display in the cafeteria. In a cage was a life-sized clothing-store dummy dressed in a prison uniform. On the chest was pinned the sign "Willie Waste, sentenced to life imprisonment by Saginaw Malleable Iron Employees."

Signs like these arouse interest. If they provided amusement, so much the better. To be effective, however, some constructive outlet for the enthusiasm aroused must be provided.

For this reason, many meetings were held while the campaign was in progress. In foreman training and safety meetings, waste was introduced as an added item for discussion. Much of the interest came through individual contact of the campaign director with each supervisor, to bring out the outstanding items of waste in each department.

For example, in the straightening department the oil used in the presses seeped through the packing and spread out over the floor. This represented a considerable loss, and, in addition, necessitated spreading sawdust around to absorb the oil—an untidy sight. To remedy this, a different type of packing was specified that reduced much of this oil loss. A collar placed around the ram caught the remainder. In these individual consultations attempt was made to concentrate upon outstanding examples of waste.

Barrels painted a bright red, and called "pork barrels," were placed in each department. Signs attached to their sides stated "Put in anything you find mislaid, which has any value." As these barrels were filled, a record was made of the total value

WASTE DOLLARS

W. H. DOERFNER
General Manager
Saginaw Malleable Iron Division
General Motors Corporation
Saginaw, Mich.

of the contents, and this was posted —the value motive again.

In a conspicuous place in the center of the plant, a large board was erected. Upon it were placed various tools and materials used by workmen throughout the plant, with the cost of each. This was changed frequently. In one set-up, for example, several bolts intended for different purposes, but which could be used interchangeably, were attached to the board with their several prices marked below. While this exhibit was of special interest to maintenance workers, the same idea was used for others. Inspectors' interest was challenged by displaying cost of freight to and from customers on pieces rejected by the customers' inspectors.

Departmental Drives

Shortly after the beginning of this drive, a number of the supervisors started campaigns of their own. Signs were printed for them, and displays arranged to focus employees' attention on waste items peculiar to those departments. These were as varied as the departments, of course. In some cases hammer damage to castings was stressed; in others, poor grinding; in still others, poor castings passed by inspectors. In one case, a box costing $1.50, designed for packing cores for the foundry, was being used for purposes served equally well by a less expensive item. This was called to the attention of all by appropriate signs on the display board.

It has been pointed out that suggestions were solicited from supervisors both by meetings with the campaign director and by individual contact. Employee participation was encouraged also by signs placed on the display boards reading, "Have you made a waste-saving suggestion to your foreman? He has suggestion blanks. Ask him for one."

A great many returns were received from this source, many excellent. Some 10 per cent of the suggestions made were productive of waste reduction. They took many directions.

One group of suggested savings was concerned with the recovery of miscellaneous expense materials—the recovery of oil at the straightening presses has been mentioned. Another group of suggestions was concerned with improving the quality of the product. Typical of this class may be mentioned that of relocating the elevating switch on the pouring ladles to a more convenient position to enable the operator to get the proper pouring height with less effort. While this was saving in effort, it helped improve quality also, since the inconveniently located switch resulted in improper pouring height.

Safety suggestions were rather numerous, but valuable none the less. In one case, the handle hole cast in the hammer was redesigned, together with the handle, giving a sturdier handle that resulted in fewer breakages and a safer tool.

Improvements in work-center layout introduced many savings in effort. In the scrap department, for example, it was suggested that more bins be introduced, and that these be elevated so that the segregation according to part numbers could be made at the same time that pieces were counted. The cost saving here was important.

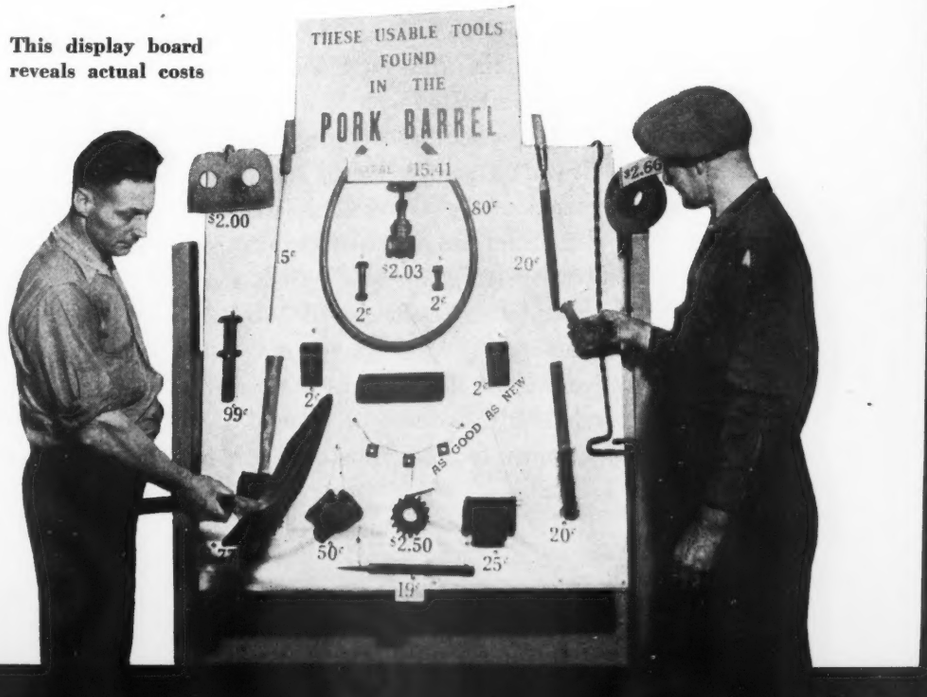
The enthusiasm and interest stimulated by a drive of this sort is not sustained indefinitely. No one expects that it will be. That is the reason for periodic campaigns to jolt the organization out of its habit groove.

Many Tangible Benefits

Nevertheless, tangible benefits such as the change in scrap-bin layout just mentioned, are distinctly noticeable, entirely apart from the very specific improvements in tools, equipment, and technique made during, or as a result of, the campaign.

Returns from customers are fewer than formerly, while scrap produced is markedly less. The monetary importance of waste has really impressed itself upon employee and supervisor alike. Then, too, there is a better general execution of company policies.

This display board reveals actual costs



EDITORIALS

Management Can get Help Here

A unique opportunity is presented to management this month. In Washington, September 19–23, the Seventh International Management Congress will constitute a management forum of tremendous proportions. Of major importance will be the "general sessions," distributed over the five days. Leaders of thought and action in America will discuss the topics from the viewpoint of their social and economic aspects.

Among the topics: What are management's responsibilities to society? What is the influence of technical progress upon social development? What must be done to fit distribution methods to modern economy? How can incentive and security be balanced? How can free enterprise be continued? What are labor's aims and responsibilities?

Among the American speakers: A. W. Robertson, Dr. Karl T. Compton, Ralph E. Flanders, Dr. Henry C. Link, W. J. Cameron, Robert Watt, Lewis H. Brown, William Allen White, Oswald W. Knauth, John G. Winant.

Match these topics and speakers and it is seen that a rare treat is in store for the person who wants to get down to management fundamentals in their broad aspects.

For those individuals who want the purely technical there will be discussions of more than 200 papers. Time schedules will permit attendance at both general and technical sessions.

Coming at this time the Congress is particularly timely for American industrial management, which literally is on the spot. Both government and labor are questioning its position in the social structure.

One objective of the International Management Congress is to give leaders of thought and action the opportunity to advise management in its relations with the public, labor, and government. Another is to give management an opportunity to re-dedicate itself publicly to the principles and practices that are promoting the well-being of society.

In this brief statement it is impossible to give a true impression of the amount of worthwhile material available. Of course the Congress office stands ready to do so. Address N. W. Barnes, Executive Secretary, 347 Madison Ave., New York, N. Y.

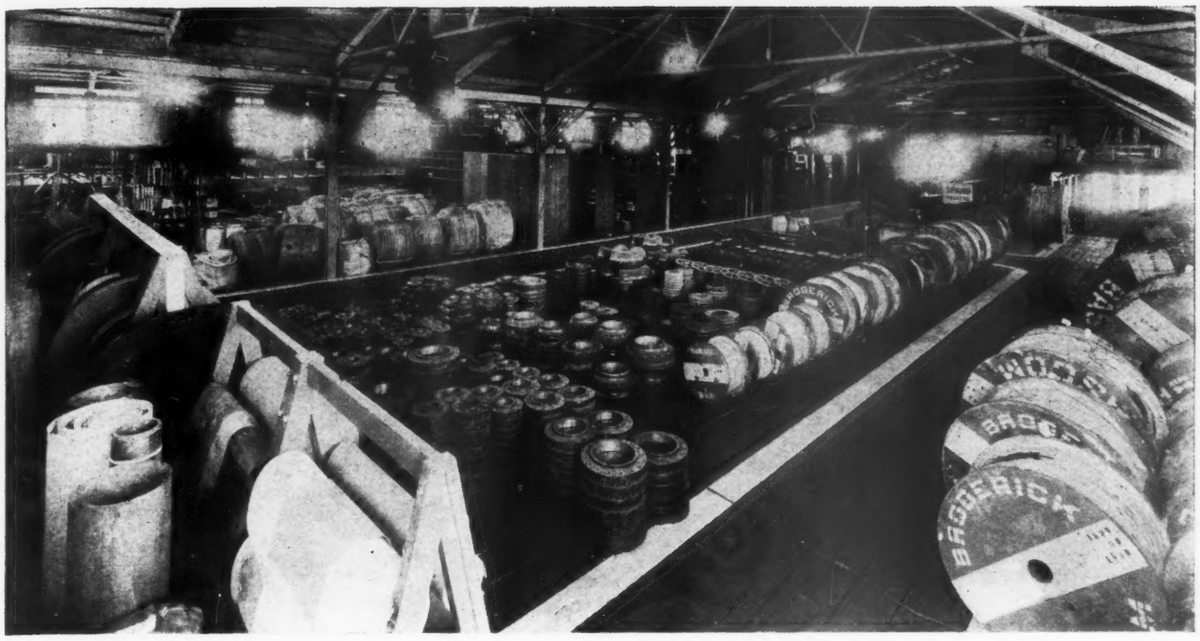
Solve Lighting and Heating Problems Now

September, in temperate climes, offers the last opportunity for doing some kinds of major maintenance operations without interruption of production or causing discomfort of employees. We are thinking particularly of the rehabilitation of lighting and heating systems.

We remember the days when the old droplight, by which we struggled to read scale and micrometers, occasionally fell into our lathe just where the chips were coming off the tool. We remember equally well the days when we hugged the salamander while numbed fingers operated stopwatch and guided pencil.

For the most part those days are gone forever. We have, indeed, come a long way in both lighting and heating. But we need to take stock now as we needed to take it then. Better lighting and better heating were available then. So are they now.

Employees who can see without strain, and who are comfortable as to body temperature, do better and more work. Also they are less likely to be on edge. "Nerves," or being on edge, may count for much in aggravating grievances, even in originating them.



How Supply Houses Help in Recovery

Business is on the upgrade. Volume of transactions is higher, sentiment is better than it has been for some months. There seems to be every prospect that production curves will have a healthy bulge during the remainder of the year.

At the same time high taxes and labor costs and sharp competition make profits uncertain, difficult to realize. Hence the efforts to cut costs in every feasible way will be unremitting. The purpose of such efforts is entirely laudable, but there may be pitfalls in some of the methods adopted. In the matter of carrying inventories, for example.

Rising business indexes inevitably bring stiffening prices of materials and supplies. When prices are increasing there is always the temptation to save by buying in quantity. With materials that policy may be justified. Supply items are a different story. The policy of stocking up on these is likely to defeat its own purpose by smothering possible savings in increased costs. Unfortunately, the amount, even the nature, of some of these costs is not always realized.

Important among them is the cost of capital tied up. Of much more moment is the serious disadvantage of having working capital frozen in non-productive channels. Unsound at any time, such a condition may be disastrous when money reserves are low and every dollar must be invested so as to bring the greatest possible return.

Cost of floor space used for storage can easily be figured in dollars and cents, but these figures do not tell the whole story. If that space were used to house production equipment, or workers, it could be changed from a liability into a profitable asset.

In addition, taxes, insurance, handling charges, depreciation, and obsolescence all take their share out of the cash box, to bring total costs up to an average of between $10 and $11 for each $100 invested in supplies. That is a pretty high rate of interest to pay for the useless privilege of having actually on hand stocks of supplies that can be obtained almost anywhere from distributors within a few hours at the most.

It is a good many years since shrewd plant operators, men who watched every item of expense, first saw the wisdom of letting someone else bear the cost of carrying their stocks of certain supply items. These plant men not only did themselves a good turn, but also made it possible for other men to establish industrial supply houses that are rendering industry a needed service, and saving it money.

Today that service is worth more to industry than ever before.

PLANT SERVICES IN A NEW PLANT

J. HARTWICK
Factory Engineer
Kellogg Switchboard & Supply Company
Clearing Industrial District, Chicago

Planning electrical distribution and water, steam, gas, and air services for maximum efficiency

MOVING into a new plant is a costly and laborious undertaking, but it has its advantages. Among them is the opportunity to locate machines for lowest-cost production, and design power, lighting, and other services for maximum efficiency.

One of the first steps in planning our new plant was to study carefully all the manufacturing and other requirements. Results of this work showed that we would need a building about 320 ft. wide and 750 ft. long. It is single-story and T-shaped, the offices occupying the cross of the T.

Our old building, on the near-west side of Chicago, is in a district that is supplied with direct current by the power company. Only alternating current is available in the new location. That meant that more than 1,000 motors, controls, and associated equipment had to be replaced with new a.c. equipment. Costly, yes, but it gave us an opportunity to standardize on makes, types, and sizes in a way that will reduce maintenance costs and the expense of carrying spare units and parts.

Considering the electrical distribution system first, primary current at 33,000 volts, three phase, 60 cycles is supplied by the Public Service Company of Northern Illinois to the outdoor transformer station where it is stepped down to 440 volts. The connection between the transformer bank and the switchboard consists of three aluminum busbars having a capacity of 2,000 amp. per phase. These bars are permanently mounted on porcelain insulators inside an aluminum casing, especially made to our order. This bus-duct is supported on steel towers between the transformer bank and engine room, a distance of 80 ft. Inside the engine room it is supported from the ceiling, a flexible connection between the transformers and duct providing for expansion and contraction of the structure.

The switchboard is located on the front edge of a cable pit 23 ft. long. Feeders for power and lighting service drop down behind the switchboard into this pit, which is 30 in. wide and 24 in. deep. Each feeder is protected by its own circuit breaker on the switchboard.

Feeders Under the Floor

Figure 1 shows the general layout of the electric power feeders and other services.

All feeders are run under the floor in Transite conduit. It is incased in a 3-in. jacket of concrete to keep moisture from entering the ducts from the outside. Cables in the ducts are insulated with moisture-proof material.

Overhead conduit could have been used, of course, but underground duct was considered more satisfactory for our purpose. Furthermore, underground construction permitted running the feeders in straight lines diagonally across the building, whereas overhead construction would have involved the use of straight lines and 90-deg. turns, thus increasing the lengths of the runs.

The largest conductors used are 600,000 circ.mil cable and the smallest 250,000 circ.mil, with the exception of one No. 3/0 feeder to the shipping and receiving department. This feeder supplies a small power panel for 440-volt motors. It is the only 440-volt power panel in the whole system. The remainder of the power distribution system is of the overhead bus-duct type, consisting of three busbars mounted on porcelain insulators and housed in a steel casing. The duct is provided with openings at short intervals along its entire length through which plugs may be attached for motor circuits.

The bus-duct is supported overhead in the building trusses, as shown in Figure 2, and branch circuits are dropped down from the plugs, which may be either a switch type or a set of fuses without a switch, to the motors. In this way the large power panels so commonly used were dispensed with, and along with them the danger of shock. A further advantage was the saving in space that

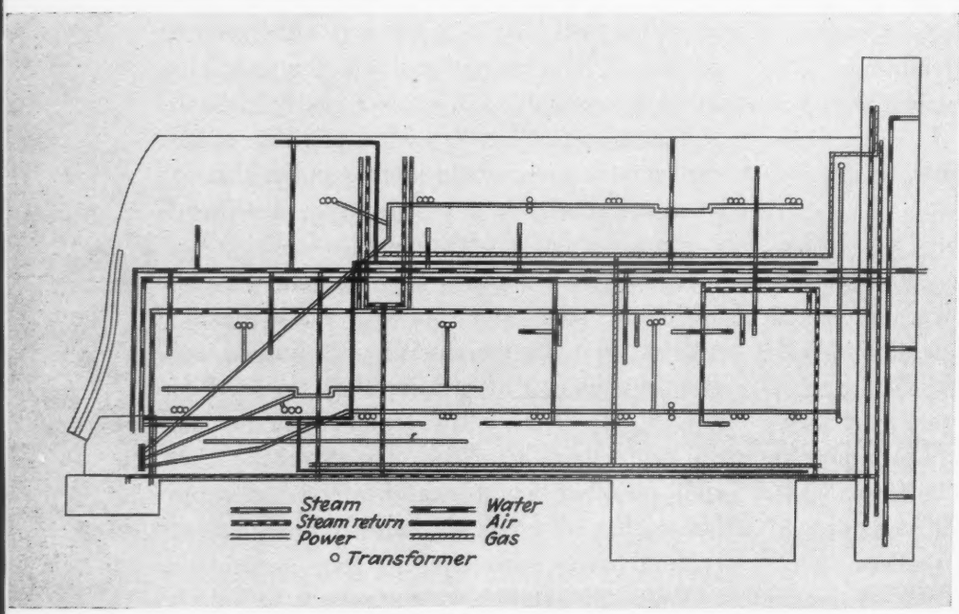


Figure 1. Schematic layout of electrical, water, steam, gas, and air services

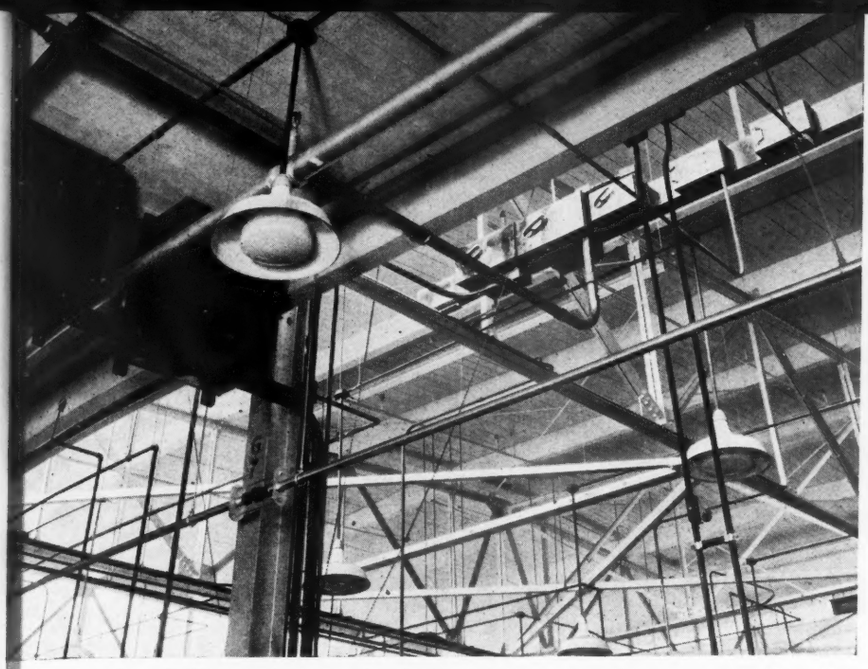


Figure 2. Electrical energy is distributed over a bus-duct system, at the right, from which taps are taken off for motors and other equipment

would have been occupied by the panels, necessarily mounted on the steel building columns.

At the same time, long runs of conduit from cabinets to motors were made unnecessary; in most cases the motors are close to a duct and only a short drop downward is necessary for connection. A number of these duct sections are located at strategic points. Each section has its own feeder from, and its own circuit breaker on, the switchboard.

Direct current at 220 volts for laboratory use, testing purposes, and other operations where alternating current cannot be used, is supplied by two 50-kw. motor-generator sets located in widely separated sections of the building. For testing purposes, where 440 volts a.c. is required, insulating transformers are used to prevent accidental shock. They are rated 440 volts on both primary and secondary, and take current directly from the 440-volt bus-duct system.

Standardized Motor Speeds

Our motors range in size from fractional- to 150-hp. rating. Those rated ¼ hp. and above operate at 440 volts, three-phase, 60 cycles. Motors under ¼-hp. rating are single-phase, 120-volt designs. All others are the squirrel-cage induction type, except one 50-hp. and one 150-hp. synchronous motor used for power factor correction. We have standardized on motor speeds of 1,800 r.p.m. in all sizes, except in a few instances where special machines had to be driven by a lower-speed motor.

Magnetic, across-the-line starters are employed with all motors up to 10-hp. rating. For motors up to and including 5-hp. rating, pushbuttons are mounted in the starter case. Motors above 5 hp. have separate pushbutton stations which are mounted on the machines or in some convenient location. Thermal overload devices provide protection for them.

Manually operated resistance starters are used for motors larger than 10 hp. and up to 50 hp. Most motors of 50-hp. rating and larger have automatic starting panels.

For lighting the offices 120-volt service is provided by two banks of transformers, 440-volt, three-wire primary with 120-volt, four-wire secondary. These transformers are single-phase, installed three in a bank near the offices, and are supplied by their own circuit directly from the switchboard.

The factory lighting system is supplied by eighteen banks of transformers properly distributed over the building area and connected to the various bus-duct sections. They are similar to the transformers for the office lighting system, and range in size from 5 kva. to 20 kva. each.

Better Lighting, Now

Formerly droplights were extensively used over benches and on machines. In the new plant we standardized on Glassteel reflectors, spaced in most instances to illuminate 90 sq.ft. of floor space each. Using 200-watt bulbs, we get 9 to 12 foot-candles intensity, the lower surface of the reflector being 9 ft. 6 in. above the floor.

This arrangement has been satis-

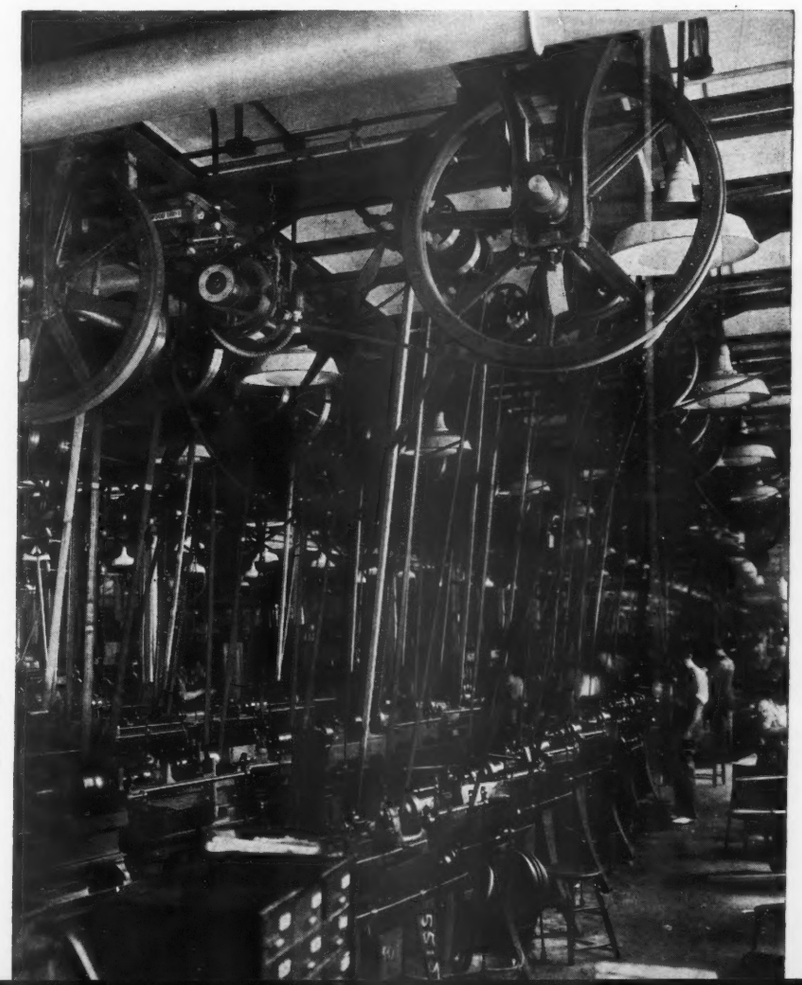


Figure 3. Wherever possible, production machines are driven from a lineshaft, in small groups. Lineshaft motors are mounted on a pivoted base, to maintain proper belt tension

factory in every case except in one department where fine wire, from 30 to 44 B.&S. gage, is wound on cores to form various kinds of coils. Operators in this department have individual lamps immediately above the coil-winding machines that provide lighting intensities of 50 to 60 foot-candles. To obtain such high intensities otherwise would have required very large bulbs and reflectors, if mounted at usual height and spacing.

In the engineering department one 300-watt Glassteel reflector with a 200-watt bulb is mounted over each drawing table. Each reflector has a white enamel curtain extending 12 in. downward from the outer circumference, which prevents glare and shadows being thrown from one table to another, and has proved very satisfactory.

Stockrooms are lighted by special reflectors designed for use between high shelving; they are mounted 9 ft. 6 in. above the floor, spaced 10 ft. from center to center, and afford excellent light where racks are erected with 30-in. aisles between them, as is the general rule in our stockrooms.

Following our practice in the old plant, group drive was used wherever possible, which covers a great many of our machines. We find that with it installation, operating, and maintenance costs are lower than can be obtained otherwise.

Standardized Speeds

Lineshaft speed has been standardized at 250 r.p.m. Every lineshaft is supported on ball bearings and is driven by its own motor running at 1,800 r.p.m. Each drive consists of a 36-in.-diam. shaft pulley and a 5¼-in. motor pulley, connected by a flat leather belt. Distance between shaft centers is in no case more than 42 in. No motor on these drives is larger than 7½ hp., and some are as small as 2 hp. This means that only a small number of machines are driven in one group, one advantage being that it is not necessary to run a large number of machines when only one or two operators are working in each group.

As shown in Figure 3, all lineshaft motors are mounted on pivoted motor bases, to keep proper belt tension.

Experience has shown that the general arrangement of our group drives is ideal under our conditions, and far ahead of the old installations in which slow-speed motors, 800 to 1,200 r.p.m. of 5- to 20-hp. ratings were used. Center distances between lineshaft and motor pulleys were long, and, in view of the low speed, wide belts were necessary. In many instances the cost of the new drive was less than the first cost of the belt alone, for one of the old installations. With the new drives it was also possible to eliminate the cumbersome belt guard required by state safety regulation under long, heavy belts.

All lineshafting, motors, countershafts, and other overhead equipment is supported by steel beams bolted to the underside of the trusses or structural I-beams. The steel supports were designed to permit attaching them by means of plates and bolts to the building structure without drilling any holes. They consist in all cases of 6-in. channels bolted back to back with ⅞-in. spacers between them to provide room for bolts.

Fountains Where Needed

Cold water for process and drinking is supplied from underground pipe as much as possible. In this way we get colder water than could be obtained from overhead piping. Also, the necessity for covering cold water pipes to prevent sweating is eliminated. The supply enters the factory at the front through a 6-in. main which runs under the floor back to the boiler room at the rear. Suitable valves and cross-connections are provided so that the water may be directed to a 50,000-gal. storage tank or a centrifugal pump in the engine room.

From the pump a 4-in. main runs back toward the office, parallel to the 6-in. main. Taps are taken off as needed for departments or washrooms, and for the drinking fountains spotted throughout the plant.

At the end farthest from the pump the 4-in. main is connected to a 6-in. main through a check valve. This valve allows water from the 6-in. main to flow into the 4-in., but when the pump is started to boost the pressure, the check valve causes the pump to build up pressure in the 4-in. main and allows water to flow to the storage tank directly from the city mains.

All underground pipe is cast iron with screwed joints. Galvanized pipe is used only above the floor.

Two air compressors driven by synchronous motors supply a maximum of 1,000 c.f.m. of compressed air at 85-lb. pressure. It is used in nearly all departments. The main air line leaves a 5x10-ft. round tank in the engine room through a 6-in. main and is distributed to all parts of the building.

City gas is used in annealing, tempering, heat-treating, and other furnaces. A 6-in. main running the full length of the building supplies the various departments. Gas mixers adjacent to the meters are used to pre-mix the gas with air.

Process steam is supplied to various departments at 150-lb. pressure by three boilers of 200-hp. nominal rating each. The main steam line is 900 ft. long, starting from the boiler through a 4-in. pipe. Expansion bends are used in place of expansion joints, both in the steam and return lines.

The factory and a portion of the office are heated by unit heaters. The heating main leaving the boiler room is 14 in. in diameter. It was considered desirable to design the heating system to operate satisfactorily at 1-lb. atmospheric pressure in sub-zero weather. The purpose was to permit us to heat the building with exhaust steam without excessive back pressure on the engines, in the event that it was decided later to generate our power.

Returns from the unit heaters and radiators in private offices carry the condensate through copper piping underground to automatic vacuum pumps. There are three of these pumps, discharging back to an overhead receiving tank in the boiler room. Expansion joints of the bellows type are provided in the underground copper return lines.

All ovens, presses, and heaters using process steam have individual steam traps; these all discharge into a common return line terminating at the receiving tank in the boiler room. The feed-pump exhaust steam is piped through oil separators into the receiving tank, or into the heating system, depending upon the time of year. A feed-water temperature of 200 deg. F. is maintained in this way without any live steam being used for heating.

Instantaneous Hot Water

Hot water for the washrooms is supplied by a new type of instantaneous water heater, using steam as the heating medium, in which the water is heated only when it is drawn off at a faucet. One heater is installed for each washroom.

We are proud of the fact that all the work of laying out departments, the electrical work, steam, air, gas, water piping and designing of supporting steel, was done by our own engineers and executives. Now that we are installed in our new quarters, we are delighted with the new conditions, such as working without artificial light, cleanliness, an abundance of fresh air, and all the other advantages and improvements of a new home.

It all boils down to picking the right grease for the right spot. Here the lubricating engineer tests greases in motors running at various speeds

One Grease Here, Another There

H. A. McCONVILLE
Works Laboratory
General Electric Company
Schenectady, N. Y.

USE OF GREASE as a lubricant goes back to ancient times, but even now there is much that is not known about its properties and proper method of application.

The universally accepted definition of a grease is that it is an oil thickened with a suitable soap base. Also, the general impression is that the oil furnishes all the lubrication, while the soap is simply a stiffening agent used to hold the oil in place. Formerly greases often contained an animal or vegetable oil, but it was discovered that such oils have poor resistance to oxidation, and that the greases containing them become gummy in time. Now greases contain mineral oils almost exclusively, but trouble from oxidation can still occur.

In general, the type of grease to be used is governed mainly by temperature encountered and speed of rotation. The average purchaser has to select suitable lubricants from a confusing array of products. Some companies market more than 100 varieties of grease, mostly for special purposes.

Another trouble is lack of standardization of greases. If a grease is bought by grades, as No. 1, 2, or 3 consistency, a No. 2 product of one maker may equal a No. 3 product of another. Commonly, as the number increases the grease becomes of harder consistency, but with some makes this order is reversed, the higher number being softer. It is necessary to specify the consistency of greases, and for factory applications the worked consistency is most desirable.

Perhaps the most widely used class of greases comprises a mineral oil thickened with a calcium soap. The consistency can vary from semi-fluid to a very hard brick grease. In general, it is advisable to use the thinnest grease that will stay in place, since the oil does most of the lubricating. Viscosity of the oil will also determine to some extent the consistency of grease to use, especially with the softer grades. This fact is recognized in greases used for one-shot pressure lubricator systems by specifying that, if the viscosity of the oil used is 500 to 800 sec. at 100 deg. F., the worked consistency should be, say, 330/10 to 350/10 mm. A.S.T.M.

Grease with a heavy viscosity oil has to be lighter to flow readily through long pipe lines, particularly in cold weather. With the consistencies mentioned, if the oil viscosity is much below 500 sec. at 100 deg. F., oil may separate while the grease is standing in containers or pipes, and the grease will leak out around the places of application.

Grease for use in one-shot systems has the broadest application for lubricating machinery in large plants. A grease of heavier consistency for use in grease cups (about 240/10 mm. worked consistency A.S.T.M.) will take care of most other applications, except electric motors. Requirements for these two types of greases can be confined to specifying the consistency, viscosity of oil, and freedom from separation of oil and soap. The average commercial grease will be practically neutral in reaction.

Aluminum-soap greases are distinguished by their clear, transparent appearance. They are subject to the same temperature restrictions, roughly, as calcium-soap greases, but are considerably higher in price. They must contain an oil of the right viscosity, or the grease will thin out undesirably at higher temperatures. Except for these restrictions, there is no reason why this class of greases should not be used, if desired, wherever calcium-base greases are used.

For Extra Heavy Loads

Graphite greases are especially useful where heavy loads are encountered, such as on the teeth of crane gears. A semi-fluid graphite grease is used as a lubricant for inclosed gears, certain parts of elevators and so on. Graphite greases have not been in favor for use in ball or roller bearings, but some of the newer types may warrant more attention.

Grease for use in electric motors has to meet such a variety of re-

quirements that extreme care should be used in its selection. The most important point is that it be of the consistency to furnish proper lubrication under the range of temperatures and speeds encountered. At no temperature within this range should the grease get so thin that it will leak past the bearing seals, or become so stiff that it channels badly, causing the balls to run dry. Ideal greases, of the proper consistency at the start and which change little on working in the bearings, are very hard to find.

As the Temperature Rises

Some greases will get thinner as the temperature rises; others will thin out within a certain temperature range and stiffen after passing this range. Selection will also depend on whether the motor is located in a moist or dry place. No grease has been developed that will stand high temperatures and be resistant to moisture. If water is likely to get into the grease, use of a calcium-soap base is indicated, remembering that the safe maximum continuous operating temperature for a calcium-base grease is about 150 deg. F. Above this temperature, water is slowly driven off, causing the oil and soap to separate.

In general, the best motor greases for a wide range of conditions are the sodium-base or mixed-sodium-and-calcium-soap-base greases. Addition of calcium to the sodium base imparts some of the smooth, buttery consistency characteristic of calcium-base greases. Otherwise, the sodium-base grease has an undesirable, long-fibered structure. The fibers tend to ball up in a bearing and hinder lubrication. These long fibers may be shortened by milling the grease, but there is always a temperature beyond which the grease cannot be heated or the fibers will lengthen again. Calcium soap also tends to make the grease less soluble in water.

Oil separation is a most important test for grease. The flow or melting point of a grease, although useful in distinguishing between soap bases, is not a deciding factor. The average ball-bearing grease will be satisfactory under continuous operation only up to 175 deg. F. For intermittent operation a temperature of 200 deg. F. might be satisfactory. Hence there is no advantage in selecting a grease with a flow point of 400 deg. F. over one with a flow point of 300 deg. F. The factor to be considered is the highest operating temperature the grease will stand.

Another important consideration is chemical and mechanical stability. Chemical stability may be defined as the resistance to oxidation and the subsequent formation of organic acids. There is a difference of opinion as to the permissible amount of free acid, but amounts not over about 0.4 per cent should not be detrimental. Mechanical stability is the resistance to changes in consistency with changes in temperature.

Too Much Lubricant

Many failures of ball bearings in motors can be traced to an over supply of lubricant. The fact that greases may change decidedly in volume upon agitation is often overlooked. All greases tend to whip up air and expand in volume, but some are much worse in this respect than others. If the housing is entirely filled with grease before a motor is started, the grease may have expanded one-third in volume when it is up to running temperature.

In a housing that is not sealed tightly, the grease will get thin and run out along the shaft. If it cannot get out of the housing, internal pressure is set up which makes the bearing run hot. When the excess pressure is relieved, the temperature drops.

A pressure-relief system on some motors takes care of this expansion by means of a relief plug in the bottom of the housing. This bottom plug should be removed when grease is applied with the motor running, preferably at its maximum operating temperature. After a few minutes all excess grease will be forced out, and the plug can be replaced.

A large variety of greases is not necessary for lubricating the machinery in the average industrial plant. However, the quality of grease used for lubricating ball-bearing motors should be investigated carefully and a product selected that best fits the needs of the installations involved. Greases available today for this purpose are superior to what they were a few years ago, and the manufacturers are steadily striving to improve them still further. Perhaps the time is not too far distant when perfect greases will be avaiable for every need.

No Dust During Alterations

R. W. CLEVELAND, *Plant Engineer*
Seth Thomas Clocks, Thomaston, Conn.

A change in departments necessitated the removal of a terra cotta wall. Since the stockroom of finished clock parts was near this wall, it was essential to eliminate as much dust as possible.

This requirement was accomplished by suspending several large tarpaulins from the sprinkler pipes about a foot from the ceiling along both sides of the wall. A spare motor-driven blower was set up and arranged to take suction from inside the tarpaulins, and exhaust into a sheet metal duct which was extended through a window. The open space at the top of the tarpaulins allowed a current of air to flow downward, taking the dust particles with it, and exhausting them outside the building.

This method was found to be very effective in preventing dust from flying around while building changes were being made, thus avoiding possible damage to stock and equipment, and making more pleasant and healthful conditions for the workmen.

If Electronic Devices Give Trouble

E. H. VEDDER
Electronic Control Section
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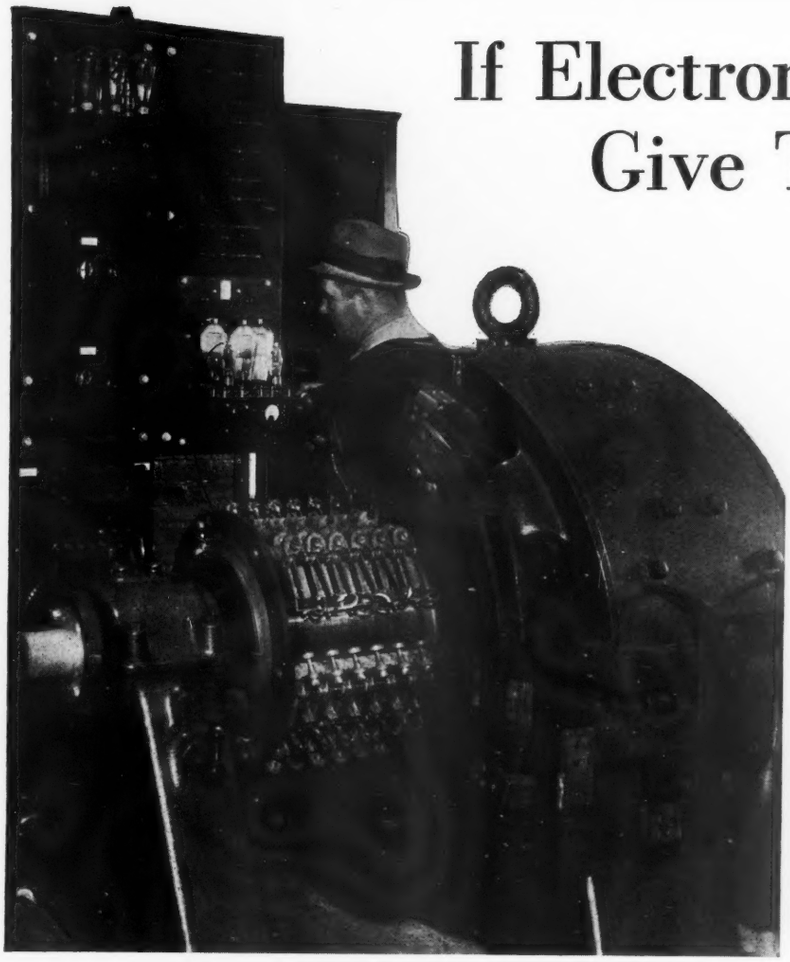


Like as not it's because some part has not been getting the periodic servicing it requires. Or else one of the perishable parts that ought to be, has'nt been, regularly replaced

PRECAUTIONS necessary in the installation of electronic tube equipment to insure satisfactory operation were discussed last month. With that background, maintenance requirements and methods of locating and correcting trouble will be easier to understand.

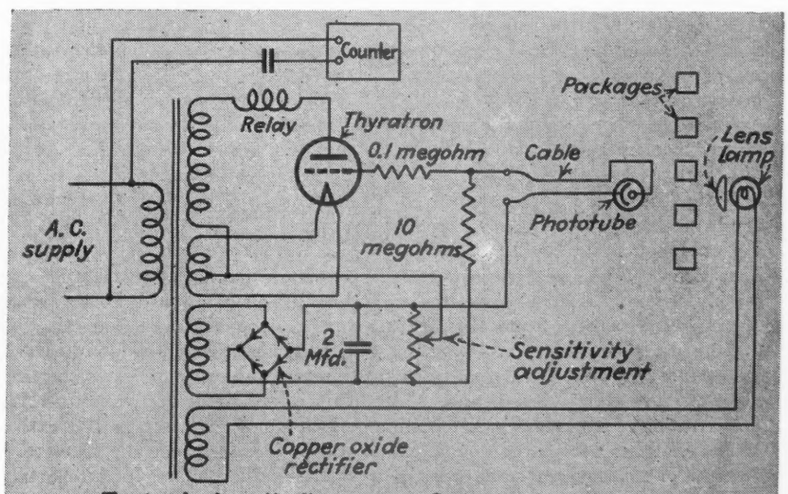
Certain parts of tube equipment require periodic servicing. Maximum freedom from trouble is obtained when all perishable parts such as tubes, lamps, relay contacts, solenoids, and contactors are replaced on a regular schedule, or checked periodically for condition.

Tubes—Although tubes are reliable, they do not have an indefinite life. Certain classes of tubes have a longer life than others. Realization of this fact will facilitate prompt location of tube failures. Table I shows the more common types of failure, in the order of probable occurrence, when the tube is properly applied and used.

Failure of electronic tubes does not always mean a burnout. It is often merely a matter of gradually decreasing quality of operation that may cause erratic operation which is not always immediately attributable to the tube.

It is advisable to carry a spare tube of each kind used, which has been previously tested in the apparatus or condition. Test sets such as are used for radio tubes are not yet available for most industrial tubes. Certain apparatus, however, is now made with test facilities built into it. Some tubes do not lend themselves readily to testing in the field and operation is the only practical guide to condition. Substitution of a tube that is known to be good usually is the quickest way of finding a faulty tube or, equally important, eliminating tubes as the source of trouble.

Relays, Solenoids, and Contactors—Give these special attention, because when used with electronic apparatus the speed and frequency of operation are often greater than called for by



Typical circuit diagram of photoelectric counter

To facilitate testing, the electronic regulator in the photograph is designed so that a voltmeter can be plugged into the tube circuits, without removing the tubes

Table I. Common Causes of Electron Tube Failure

Name of Tube	*Usual Life*	*No. 1 Cause of Failure*	*No. 2 Cause of Failure*	*No. 3 Cause of Failure*
Phototube	One to several years	Gradual decrease of sensitivity	Gas leakage. Open circuit or short will usually show up early	Mechanical
Pliotron (amplifier)	1,000 to 3,000 hr.; in special cases 10,000 hr. or more	Gradual decrease of filament emission resulting in low sensitivity or ultimate filament burnout		
Kenotron (rectifier)	1,000 to 3,000 hr.; in special cases longer	Gradual decrease of filament emission resulting in low output or ultimate filament burnout	Gas leakage. Tube glows or filament burns out with discoloration of glass. May act like a short through tube, which will fail to rectify	Mechanical
Phanotron (rectifier)	About 3,000 hr.; longer if conservatively applied	Gradual decrease of filament emission resulting in high arc drop, stripping of active coating from filament, and eventually filament burnout	Gas leakage. Tube has pink or off-color glow different from normal. Accelerates type of failure in No. 1. May fail to rectify, and develop short circuit	Mechanical
Thyratron	About 3,000 hr.; longer if conservatively applied	Gradual decrease of filament emission resulting in high arc drop and stripping of active coating from filament. Usually fails to perform properly before filament burnout occurs	From No. 1, tube may develop erratic characteristics near the end of its life	Gas leakage. Tube has pink or off-color glow different from normal. Accelerates type of failure in No. 1 and 2. May fail to rectify. Can develop short or loss of grid control
Ignitron	One to several years	Overloads. These result in backfires or failure to rectify, which fouls tube. May also cause failure to stop conducting when ignitor is not energized. May also damage ignitor, or strain glass seals and cause leakage	Air leakage. Tube shows pink or abnormal color of glow. Will not control or stop conducting when ignitor is not energized. May refuse to pass current at all in final stages	Ignitor failure. Tube requires excessive ignitor current to fire, evidenced by blowing fuses or by heavy load on ignitor control tubes. In advanced stages acts like short from ignitor to mercury cathode
Grid Glow	1,000 to 3,000 hours	Failure to conduct current. Electrode material sputters and darkens glass. Breakdown voltage increases because gas pressure in tube decreases	Air leaks. Tube develops pink glow characteristic of change. Results in low or high breakdown voltage	Mechanical
Lamps	100 to 3,000 hr. Life depends on voltage used.	Filament burnout	Blackening of bulb prior to burnout	

their design. Many electronic units, such as welding timers and phoelectric relays on packaging machines, now operate up to 150 times a minute. Considerable attention may be required to maintain reliable operation of relays at such speeds.

Optical Systems—These require periodic cleaning, the frequency depending on the location and precision of operation expected. In most instances, weekly cleaning of lenses is desirable. In especially dirty locations, daily cleaning may be necessary.

Vacuum Pumping Systems and Continuously Pumped Tubes—As the power rating of apparatus is increased, sealed-off tubes become uneconomical because of replacement costs. Sealed-off Ignitrons are now economical up to between 100 and 250 amp. per tube, average current rating, but when greater ratings are attempted it is less expensive in first cost and maintenance to use tubes that can be overhauled. These are kept evacuated by a vacuum pumping system assembled as part of the complete apparatus. All tubes in the unit are manifolded to the one pump.

Little maintenance is required on a vacuum pumping system except overhauling once a year. These systems are used on all large steel-tank mercury-arc rectifiers and on the larger Ignitron tube assemblies for rectification or welding. The yearly overhaul of the pumping system is relatively simple if a few rules are observed.

It consists of three major parts. A mercury-vapor pump exhausts from the tubes into the second element, known as an interstage reservoir. From here, the gas is pumped to open air by a motor-driven pump. Between the motor pump and the interstage is a check valve which prevents atmospheric pressure from reaching the interstage when the pump is stopped. In some equipments a contact-making manometer on the interstage operates the motor pump just enough to keep the pressure in the interstage low enough for the mercury pump to work against the interstage back pressure.

The mercury pump has no moving parts and consists of an electrically heated mercury boiler and jets through which the mercury vapor is ejected, to be recondensed by water-cooled surfaces and returned to the boiler. The gas in the tubes is swept along with the vapor out of the tubes and into the interstage. The maximum interstage back pressure against which the mercury pump will operate is about 1.5 centimeters of mercury.

About every nine months the interior parts of the pump should be removed and cleaned out. Pour out the mercury in the boiler and if dirty, replace it. If the mercury is clean, it may be used again, but the amount should be checked and mercury removed or added to make the correct amount.

The vacuum pump is directly coupled to an induction motor. If it is used for either intermittent or continuous operation, no major maintenance or repairs should be required for several years. Inspection periods vary with individual users, and it is possible to allow some flexibility. The following inspections are suggested:

1. Check the level of the oil every six weeks.

Table III. Causes o

Symptoms	*No. 1*
Erratic; misses count	Dirty lenses, faulty focus steam, sunlight, or other interference
Acts like light is on continuously. Relay stays closed	Leakage across phototube leads or connection
Acts like light is off continuously. Relay stays open	Dirty lenses or faulty focus
Relay chatters	Dirty lenses, or optical system out of focus
Short lamp life	High line voltage
Short Thyratron life	High or low line voltage
Short phototube life	Phototube too hot
Sluggish relay operation	Low line voltage
Thyratron filament does not light	No line voltage

2. Check the oil every three months to determine whether it contains any dirt or grit.

3. If the oil is dirty, replace it with clean, vacuum-pump oil.

It is desirable every six months to check the time required to evacuate the tubes to which the pump is connected. If the time has greatly increased, it will be necessary to make whatever adjustments are required.

The pump should be overhauled and cleaned every eighteen months to three years.

Maintenance Is Simple

An Ignitron tube for use with a vacuum pumping system consists of a sealed cylinder, the lower portion of which forms the mercury pool cathode. The graphite anode is held in place by a copper rod that conducts the power current from the terminal to it. The anode assembly is insulated from the tank by a porcelain bushing. In the larger-sized tubes the cathode mercury is cooled by passing water through a nickel tube immersed in the pool. The tube is cooled by copper tubing soldered to the tank to obtain good thermal contact.

The only periodic maintenance required by Ignitron tubes is the cleaning of insulation surfaces and flushing out the water circuit, if the cooling water deposits sediment or scale. Tubes may operate from one to several years without a major overhaul. When it is necessary to remove the anode plate, the mercury in the cathode should be inspected. If it is only slightly oxidized, it should be skimmed off; when dirty, it should be replaced. Quantity of mercury to be added depends upon the size of the tube; instructions accompanying the equipment should be followed carefully. The mercury level in the cathode should be increased or decreased to correspond to the correct value any time that the Ignitron is open. If the mercury level is not correct, check the level in the mercury vapor vacuum pump.

When an Ignitron tube is opened, the dirty parts should be cleaned. Handle all interior parts only with clean cotton gloves. Metal parts may be cleaned with a sandblast, sandpaper or wire brush. The graphite may be smoothed off with sandpaper. Replace any burned or broken parts.

Failure of an Ignitron to operate may be because the ignitor does not touch the mercury. This condition can be detected by ringing through from the ignitor terminal to the tank. If no circuit exists, the ignitor should be readjusted by slightly changing the position of the ignitor flange. This is done by tightening the top bolt and loosening the bottom bolt, or *vice versa*. If a circuit cannot be made in this way, the ignitor should be removed, inspected, and repaired.

(*Continued on page* 120)

Table II. Instruments Used in Checking Electronic-Tube Devices

Instrument	*Use*
Portable ohmmeter, capacity up to about 100,000 ohms	Measuring resistances up to range covered by insulation resistance meter; checking for shorts or open circuits
Portable d.c. milliammeter, scale 0 to 10 0 to 25 0 to 100	Measuring plate currents of Pliotrons and small Thyratrons. Also for other low-current control circuits
Portable, high-resistance d.c. voltmeter having a resistance of 1,000 ohms or more per volt and scales to cover the range from 0 to 750 volts	Measuring plate and grid voltages especially where supply is weak and low-resistance instruments usually available would not give correct reading
Portable a.c.-d.c. multi-scale voltmeter to read from 2.5 to 750 volts	General-purpose checking of transformer and line voltages, such as to filaments and plate
500-volt insulation-resistance meter to read from 100,000 ohms to 100 megohms	Measuring high resistances commonly used in the grid circuit of tubes and to check leakage through and over insulation
Portable d.c. microammeter to read 0 to 10 microamp., preferably with additional scales to read up to 500 microamp.	Measuring phototube currents; also current in circuits of very high impedance
Cathode-ray oscilloscope, preferably with 3-in. screen	Studying wave shape of current and voltage-also transient phenomena
Usual a.c. and d.c. ammeters and current transformers	For usual power measurements

Photoelectric Counter Troubles *(Correct application and installation assumed)*

No. 2	*No. 3*	*No. 4*	*No. 5*	*No. 6*	*No. 7*	*No. 8*
Hairline adjustment	Defective tube	Loose connections in photoelectric relay or on light source; bad sockets	Sticking relay	Line voltage variations	Bounce of counter or stutter of relay, giving double count	Intermittent shorts or opens in rectifier, capacitor, or transformers
Faulty sensitivity adjustment	Too much light, or not enough light change to cause operation	Faulty Thyratron	Extraneous light reaching phototube either directly or by reflection	Sticking relay	Open grid circuit, failure of grid voltage rectifier or capacitor, or faulty adjustment of potentiometer	Phototube too hot
Defective sensitivity adjustment	Defective Thyratron or phototube	Loose connections to phototube or in photoelectric relay	Low line voltage	Burned-out transformer		
Hairline adjustment	Too slow interruption of light	Defective Thyratron	Defective phototube	Low voltage		
Vibration						
Defective Thyratron						
Defective Thyratron	Loose socket contact on tube prongs	Loose connections	Burned-out transformer			

When You Need SMALL MOTORS

There's a suitable type for each job, but a number of questions must be answered before you can match motor and load characteristics

APPLICATION of fractional-horsepower motors expands in ever-widening circles to new appliances, new tools, air conditioning equipment, and the thousand-and-one devices that are motorized today.

These applications impose different load characteristics. To meet these conditions satisfactorily, and thus give the user the most for his dollar, several different types of fractional-horsepower motors have been developed. Incidentally, that fact provides the best answer to the oft-heard question: "Why do you electric motor fellows make so many different types of product?"

To Compare Various Types

Suppose we list all the general factors that come up at one time or another in the selection of fractional-horsepower motors and then analyze the importance of each. These factors can then be used as a means of comparing the various types of motors:

1. Current specifications:
   - (*a*) Direct current
     - Voltage
   - (*b*) Alternating current
     - Voltage
     - Number of phases
     - Frequency

2. Horsepower:
   Rate at which work is to be done—continuous or intermittent duty

3. Speed specifications, r.p.m.
   Constant, multi-speed, varying, and adjustable speed

Performance characteristics include:

1. Torque or turning effort:
   - (*a*) Static, required to start load from rest
   - (*b*) Pull-up, required to bring load up to speed
   - (*c*) Breakdown, load that will stall motor

2. Starting efficiency:
   The locked or static torque per ampere under fixed conditions of voltage and frequency

3. Running efficiency:
   Relation of the power output to the power put into the motor, as a per cent of the latter

4. Power factor:
   This is a factor in a.c. circuits only. It represents the ratio of true watts as measured by a wattmeter to apparent watts obtained by multiplying volts times amperes

Physical characteristics embrace:

1. Temperatures:
   Maximum safe allowable operating temperatures have been standardized by the National Electrical Manufacturers Association. Standard, open-type motors are rated 40 deg. C. maximum above room or ambient temperature. The splash-proof type is rated 50 deg. C. and the inclosed, fan-cooled, and explosion-proof are rated 55 deg. C. Motors operating above these maximum temperatures should be checked for overload and other conditions that may be causing the high temperatures; otherwise the life of the insulation will be reduced.

MARTIN SCHIFF
Chief Engineer
Century Electric Company, St. Louis

2. Insulation materials.
   - (*a*) Standard insulation for average conditions
   - (*b*) Special insulation for unusual conditions

Current Specifications of the power supply determine whether a d.c. or an a.c. motor must be used. If an a.c. motor is required, it must be chosen to suit the voltage, frequency, and number of phases.

Horsepower. Determination of the horsepower required to drive the load is essential. If you over-motor you are wasting money. If you under-motor, the operating temperature will rise beyond safe limits and may seriously damage windings and insulation.

Standard, general-purpose motors are always rated for continuous duty, which meets the requirements of the large majority of applications. For intermittent-duty applications or those requiring short-time operation under unusual load requirements, it is advisable to consult a motor expert.

To make due allowance for unlooked-for conditions when selecting the horsepower rating, is good insurance against trouble.

Speed Specifications. Speeds are usually specified at full load. Most fractional-horsepower motor applications are single speed. When more than one speed is desirable, load characteristics at the various speeds are a very important factor and the motor expert should be called in.

Torque. With identical horsepower rating, the torque characteristics of the different types of motors can and do vary widely. This factor is usually one of the most important.

Torque a Big Factor

Torque means turning effort and is measured by the force the motor will exert at a given distance from the center of the shaft. For example a 1-hp. motor driving full load at its normal speed of 1,750 r.p.m. will be developing a turning effort of approximately 3 lb. or 48 oz. at a distance of 1 ft., which may be expressed as a torque of 3 lb.-ft. or 48 ounce-feet.

Some loads are difficult to start; others, easy. So far as torque characteristics are concerned, a motor must do three things: (1) Start the load from rest—it may be easy to start, as in the case of light power tools, oil burners, light fans or blowers; or the full load may have to be started from rest, as with refrigeration compressors, and piston pumps. (2) Bring the load up to speed—this factor may be the weak link in an application; the load may be easy to start but difficult to accelerate up to

Bakery conveyor is driven by a ½-hp., 1,750-r.p.m., ball-bearing motor with inbuilt gear reduction. Gear ratio of 12:1 gives a 146-r.p.m. output

speed because there may be a high moment of inertia (heavy fly-wheel effect), high friction, or the load may increase as the cube of the speed, as in the case of fan or blower drives. (3) Handle unexpected demands placed upon it, either in the form or extra load or momentarily reduced voltage.

Starting Efficiency is of extreme importance in a fractional-horsepower motor application. It is important because a high in-rush of starting current tends to reduce line voltage. The torque output of a motor changes as the square of the change in applied terminal voltage. For example, a 110-volt motor will produce only 81 per cent of its rated torque if operated on 99 volts.

In general, motors with the highest starting efficiency will produce less light flicker at starting and during acceleration. Furthermore, a circuit fuse of lower ampere rating as compared to the motor full-load current, can be used. This feature is of great importance where protection against overcurrent or overheating is not provided.

Running Efficiency will not affect the reliability of operation. A few points variation, one way or the other, in running efficiency of small motors will make a difference of less than a few dollars a year in the power bill.

Power Factor in general is not important since the average well-designed motor built in accordance with NEMA standards has minimum values which are acceptable to all the controlling bodies.

Temperatures that are abnormally high may be the result of an actual overload or reduced capacity as a result of subnormal voltages. Overload protection is an important factor in applying motors because it protects the windings and insulating materials by opening the circuit before the temperature rises to dangerous values.

Ordinary fuses in the circuit offer very little protection, because if the fuses have capacity large enough to handle the large inrush current at starting, they are too large to protect the motor under sustained overloads that will destroy the windings.

There are available so-called inverse-time protective devices. They are essentially a fuse or thermal switch which is used in connection with a heater element. Predetermined values of overload current flowing through the heater will melt the fuse or open the switch.

The operating principle is based on the fact that the high inrush current will not warm up the heater element sufficiently to open the circuit because it is on for only a few seconds. However, on sustained running current that is higher than normal it will open the circuit and protect the winding. This type of protection can be obtained built into the motor. This is desirable because the device can be calibrated exactly for the particular type and size of motor with which it is used. Some of these built-in thermal protective devices

(*Continued on page 118*)

AVERAGE CHARACTERISTICS OF FRACTIONAL-HORSEPOWER MOTORS*

Single Phase Motors

	Repulsion-Start Induction	*Capacitor Start*	*Cap. Start, Cap. Run*	*General-Purpose Split Phase*	*Polyphase Cage Squirrel*	*Direct Current*
Static torque** per cent.....	550	435	378	230	300	650
Pull-up torque per cent.....	225	250	250	200	Will pull up any load they can start	
Breakdown torque per cent..	265	265	265	230	350	
Power factor per cent.....	64.0	64.0	86.0	73.0	75.5	
Efficiency per cent.....	66.0	65.0	65.0	67.0	70.0	70.0
Locked-rotor current, amp...	13.0	19.0	18.0	32.0	11.0	15.0
Starting efficiency, oz.-ft. per amp.....	5.08	2.75	2.52	0.87	1.9	5.2

*1/4 hp. four pole, 110-volt, 60-cycle a.c., and 110-volt d.c. motors.

** Values of torque are expressed as a percentage of full-load torque. That is, 650 per cent static torque means that it would be 6 1/2 times normal or full-load torque.

HOW MUCH ELECTRIC H

Calculating the wattage required for most electric heating applications isn't difficult: use of a few simple formulas will give an answer that is close enough for all ordinary purposes

SUCCESSFUL APPLICATION of electric or other heating devices depends to a considerable extent on thorough understanding of some fundamental facts. For example, it is important to realize that heat is a form of energy which may be transferred from one body or substance to another by:

1. *Convection,* which means the transfer of heat caused by movement of some medium. Water surrounding an electric immersion heater becomes warmer as it absorbs heat from the unit. It then rises because it has become lighter. Colder water moves to take its place, and in that way convection currents are created. The same action takes place with air that passes over a heated surface. Becoming warmer, it becomes lighter and passes along, carrying with it the heat taken from the hot surface. Cooler air then comes in to take its place.

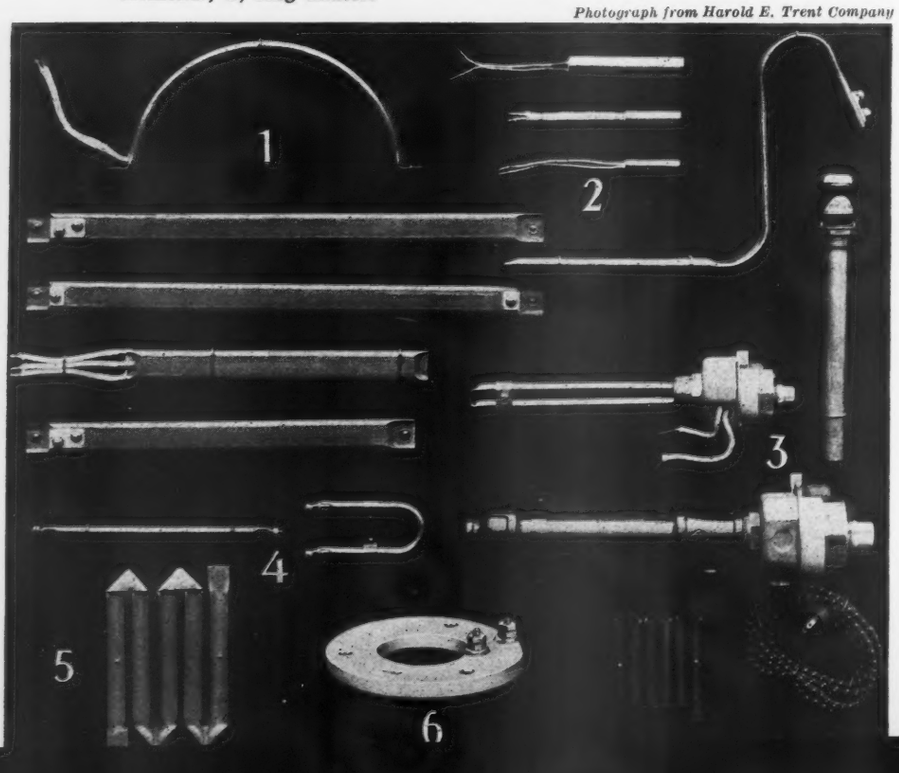
2. *Conduction,* which means the transfer of heat by direct contact of one body with another, or from one part of a body to another part of the same body. When one part of a body is heated, the molecules in the heated portion vibrate faster than normal. This increased speed is transmitted to the adjacent molecules which, in turn, increase their speed and raise the temperature in the adjacent part, until equilibrium is established. Incidentally, the rate of heat transfer varies greatly with different materials. For example, the rate of conduction in copper is greater than it is in iron.

3. *Radiation,* by which we mean that heat is transferred by energy waves passing through the air. When these waves strike any other body having a lower temperature, the energy manifests itself as heat, raising the temperature of that body.

Here let us differentiate between radiation and convection when applied to the heating of a room. Air through which radiation passes, is heat-transparent and therefore does not become warm in that way. Its temperature eventually is raised because the radiant energy is converted to heat when it is absorbed by the walls and furniture in the room, which in turn heat the air. That's radiation. On the other hand, convection directly warms the air only of the room, as previously explained.

Among the more widely used types of electric heating elements are: 1, strip heaters; 2, cartridge units; 3, immersion heaters; 4, tubular heaters; 5, ribbon elements; 6, ring heaters

Photograph from Harold E. Trent Company



Electric heat is considered to be 100 per cent efficient, which means that the output of the heating unit measured in B.t.u. of heat energy is the same as the input of electric power from the source of supply when converted to the same units.

The field of heavy-duty, high-temperature heating which involves the use of electric melting pots, furnaces, and so on, is too widely known to need discussion here. It is in the smaller applications of electric heat to accomplish results previously obtained by steam, gas, or oil that lack of knowledge of the different types of elements available, and how to apply them, may result in disappointment.

Basic types of elements now available are commonly known as strip, immersion, tubular, and ring heaters, cartridge units, and ribbon elements. They are furnished in different lengths, wattages, voltages, and terminal arrangements. Variations can be made to get different results.

Same Rating, Same Heat

All are embedded types of units, with the exception of the heavy ribbon element. The embedded construction is more rugged, less of a fire hazard, will stand more abuse, and can be more easily handled. Such units are limited to a maximum of 800 to 900 deg. F. for any application.

Every electric heating unit gives off heat in proportion to its wattage. One unit rated at 1,000 watts will get just as hot and give off the same amount of heat as another unit of the same rating, regardless of its size or shape. The secret of efficient electric heating is in the proper application, by selecting the correct size and shape of units and directing the heat to the right place. If the heat is conducted away as quickly as it is generated in the heating unit, you will never have trouble with units becoming overheated and possibly injured. Such injury would occur without any increase of current, but by overheating the materials from which the heating unit is made.

Strip heaters of the proper length and wattage are used for heating air,

C HEAT?

WM. G. MEROWIT
Wm. G. Merowit Company
Buffalo

as in ovens, rooms, ducts, crane cabs, and so on. They may also be clamped tightly to containers to melt solids or keep liquids hot; attached to machines to keep part of the machine hot, as in candy and box making; or used on some pipe lines to keep materials flowing at the proper temperatures. Strip heaters can be furnished for single- or three-heat operation.

Ring heaters are used where a cylindrical-shaped unit is advantageous, as under a round kettle, in the die of a machine, and so on. They can also be furnished for three-heat operation.

Where They Are Used

The cartridge heater is designed for localized heating. When of proper length it can easily be pushed into a hole to heat a casting, platens for plastic molding, or embossing presses. All cartridge units are made a few thousandths of an inch undersize, since they depend on good contact to dissipate the heat. In some sizes they can be furnished for three-heat operation.

Immersion heaters have a wide field in electric heating. They are made in varying wattages and lengths, with different kinds of sheathing, depending upon the use, and for both stationary and portable service. When stationary, they can be screwed into metal tanks or bolted on with flanges. They are used to heat such fluids as compounds, oils, or water by setting up convection currents in the liquid. When used for water heating, the sheath is usually of copper or brass. With oils it is of steel. For use in certain acid solutions, the sheath is lead-covered or it can be made of Monel metal, stainless steel, or other special alloys.

In all cases the sheath or heated length must be completely immersed at all times, because immersion heaters operate by convection and are given high wattage ratings compared to the surface of the heater. If they are not totally covered by the liquid, overheating will occur.

These heaters can be furnished for either single- or three-heat operation.

Rated 14 kw., 230 volts, direct current, this box-type furnace operates at 1,850 deg. F. Temperature variation is approximately 10 deg. F., plus or minus, throughout the working space

The tubular heater is usually $\frac{3}{8}$ in. in diameter and is available in various lengths and wattages. It can be conveniently bent for heating pipes, parts of machines, dies, and the like, or used as an immersion heater.

Ribbon heating elements provide a means of applying heat to the outside of tanks, pots, or kettles, and for heating air in ducts, ovens, and furnaces. This type of element has the advantage that it does not have to make contact with the surface to be heated, as with strip heaters, since it heats by radiation. It lends itself to the curving or forming of each flat rib to give it greater mechanical strength against bending and sagging. It is also folded back and forth to give an equal cross-section throughout the total length of the unit, even at the folded-over parts.

This element is used mostly for higher-temperature work, but can be used to advantage at the lower temperatures, especially where it is important to prevent carbonization, because it gives more even heating at a low wattage per square inch of element surface.

For heating air, the strip, tubular, or folded and formed units can be used. For most low-temperature applications—that is, up to 800 deg. F. —strip heaters of the proper size and number are used. A modification of the strip heater is fitted with vanes which are welded to give better contact.

The vanes increase the surface area, which means freer radiation and therefore higher wattages for the same length, or the same wattage in shorter lengths. However, folded and formed ribbon elements built into a frame make a better air heater because of the larger exposed surface area and the closer temperature control, with quicker response.

In estimating the amount of heat required for a room, the proper procedure would be to calculate the heat losses through the walls, floors, and windows, and the heat needed to warm the entering air. Then after adding some extra wattage for safety you will have the amount of heat

required. However, for quick rule-of-thumb calculations, allow from 4 to 6 watts per cubic foot of air to be heated to maintain say 70 deg. F. in an average well-constructed room with no less than zero outside.

A good formula for quick calculation is:

Kw. of heaters $= T \times [(C + 10S) \div 100{,}000]$

Where T = Temperature difference between interior of room and outside in degrees F.

C = Cubic feet of air in room

S = Total square feet of wall, floor, and ceiling area

It is advisable to add about 20 per cent more wattage for variables, such as windy exposure and walls of poor construction.

As an example, suppose it is desired to heat a small frame office building, standing alone, which is 17 ft. long, 13 ft. wide and 9 ft. high:

C = Cu.ft. of air $= 17 \times 13 \times 9 = 1{,}989$

S = Total sq.ft. of wall, floor and ceiling area or, $2 \times (17 \times 9) = 306$

$2 \times (13 \times 9) = 234$

$2 \times (17 \times 13) = 442$

982

Assuming 70 deg. F. inside with zero outside:

Kw. $= 70 \times [(1{,}989 + (10 \times 982)] \div 100{,}000 = (70 \times 11{,}809) \div 100{,}000 = 8.27$

That is, 8¼ kw. will heat the room, but to be on the safe side, since it is a frame building, add 20 per cent, making a total of, say 10 kw. of heaters.

Checking this result with the rule-of-thumb method previously mentioned:

10,000 watts ÷ 1,989 cu.ft. = 5 watts per cu.ft., approximately

Either separate strips can be selected to total the wattage required or complete stationary or portable air heaters with protective covering may be used.

In many instances electric unit heaters are used, which have a motor-driven fan that blows air over the heating element, giving better air circulation and quicker heating.

Thermostatic control is recommended. When the desired temperature is reached, the thermostat will automatically cut off the electric heaters and turn them on again when the temperature drops. A thermostat pays for itself quickly. Larger-size units can be used to give quicker heating, but no more power will be consumed because the thermostat will cut them off as soon as the desired temperature is reached.

Location of air heaters is important in obtaining good distribution. The stationary convection type of heater should be mounted close to the floor. It is advisable to divide the total wattage required among two or more units, when heating large spaces. On the other hand, the fan-driven type of unit heater can be mounted overhead, out of the way, because it forcibly circulates the air, instead of depending on natural circulation only.

An oven is essentially a comparatively small compartment heated to not more than 900 deg. F. An important consideration is that the oven be properly insulated to conserve the heat. It should be ventilated to take off vapors and moisture. The heating units should be designed and installed to distribute heat evenly.

To determine the kilowatts of heat required for any oven calculate: (1) Heat absorbed by the air in the oven; (2) heat lost through the walls; (3) heat absorbed by the material to be treated. Adding those three quantities will give the kilowatt capacity needed to operate the oven at the specified temperature. Owing to the variables involved, the result obtained will be approximate, but close enough for practical purposes, particularly if a factor of safety is added. It is recommended that thermostatic control be used in all cases to maintain constant temperatures and conserve power. A fan or blower may be used to circulate the air and insure uniformity of heating.

To illustrate the calculations involved, assume that an oven 10 ft. long, 8 ft. wide, and 6 ft. high is required to bake the finish on a charge of 400 lb. of sheet-iron signs at a temperature of 460 deg. F. The walls are 4 in. thick and there will be six changes of air per hour. Room temperature is 70 deg.

1. To calculate the heat absorbed by the ventilating air use the formula:

Kw.-hr. $= (C \times A \times W \times S \times T) \div 3{,}412$

Where C = Cu.ft. of air in oven

A = Number of air changes each hour

W = Weight of cu.ft. of air at room temperature = 0.075 lb.

S = Specific heat of air = 0.242

T = Temperature rise

Substituting, $[480 \times 6 \times 0.075 \times 0.242 \times (460 - 70)] \div 3{,}412 = 5.97$ kw.-hr.

2. In calculating heat lost by radiation, it is best to allow a factor of safety to cover losses around doors, through supports or metal fastenings, and drafts of air which take heat away from the outside of the oven. In a well-made factory oven a factor of 2 is sufficient. Use a factor of 3 if the oven is home made or old.

Use the following formula, assuming for constant K a value 0.5 B.t.u.

(Continued on page 118)

Soil-Heating Cable Helps in Testing Samples of Concrete

SOURCE, *General Electric Company, Schenectady, N. Y.*

Electric soil-heating cable is used in a controlled-atmosphere chamber at The Master Builders Company laboratory, Cleveland, to assure accurate compressive-strength tests on samples of concrete mixtures. These tests must be made in a room kept at approximately 70 deg. F. and 100 per cent relative humidity. Small samples are cured in this atmosphere and tested at predetermined intervals over a period of a year.

Formerly, a water bath was used to keep the samples at a constant temperature. It proved to be cumbersome and generally unsatisfactory. At the suggestion of an electric-heating expert the water bath was replaced with five lengths of soil-heating cable placed about the base of the test

room. Heater controls were installed outside the laboratory, with a thermostatic bulb inside to regulate the temperature automatically.

Water sprays at the top of the room maintain 100 per cent humidity.

Phone Systems Within the Plant

Photographs from American Automatic Electric Sales Company

Figure 1. Wall-type dial telephone for a private automatic inter-communicating system

Figure 2. Outdoor stations make it possible to provide telephone service from any point in the yards

FREDERICK SMITH
Vice-President
J. O. Oliver & Company, Inc.
New York

LAST MONTH we considered a simple type of intercommunicating telephone system that will meet all ordinary requirements for a plant needing a maximum of 25 stations. In very large plants anywhere from 25 to 200 or more stations may be needed for adequate intra-plant service. These stations may be fairly close together, or they may be distributed over a wide area, in several buildings.

At many of these locations, communication only within the plant is required; at others provision must also be made for communication over the city telephone system.

As was pointed out in the article in the July issue, it will usually be found that the greatest efficiency and economy can be obtained by limiting the number of telephones for outside service to those actually required, and handling all communication within the plant by a private system. Although this arrangement will necessitate separate telephone instruments for department heads and others who require both inside and outside service, these double-track facilities will materially improve service over the city system, since both the operator and the outside telephones are relieved of all interior traffic.

The type of system best adapted for general interior intercommunication when stations are widely distributed, and necessary when more than 25 stations are required, is a private automatic exchange, frequently referred to as a P.A.X. system. The equipment required for an installation consists of a centrally located automatic switchboard or switching machine and dial-type telephones, Figure 1, each of which is connected to the switchboard by a single pair of wires. Figure 2 shows an outdoor station.

In operation, any station may establish a connection directly with any other station by removing the receiver from the hook, waiting until the dial tone is heard, and then dialing a two- or three-digit number. The switchboard mechanism automatically makes the required connections and intermittently rings the station called until someone answers or the connection is released by replacing the receiver on its hook. If the called station is engaged in conversation with another station, a distinctive "line busy" signal in the form of an intermittent buzz is transmitted to the calling station.

Since it is impossible for any station to cut in on a busy line, matters of a confidential nature, as well as

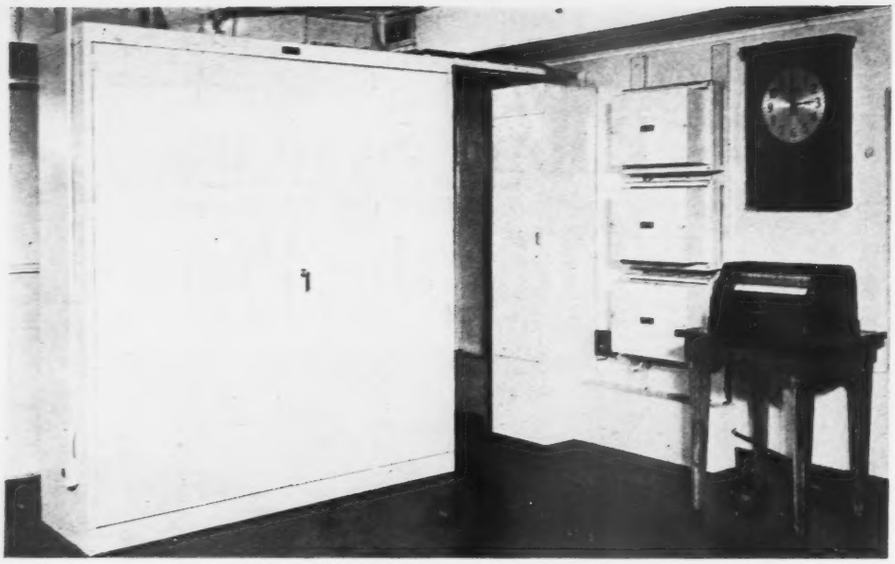


Figure 3. The automatic switchboard is housed in the large cabinet at the left. Directly beneath the clock is the multiple recorder for the watchmen's calling and recording system

routine business, may be discussed freely without danger of eavesdropping.

In addition to the ease and quickness of calling, and the privacy assured by an automatic system, several features or services of particular importance in industrial plants may be incorporated in a P.A.X. installation. One is a code call for locating an executive or department head wherever he may be in the plant. If no answer is received to a call made in the regular manner, a special number is dialed which establishes a connection with the code-call circuit. Then by dialing the code number assigned to the person wanted, his call is sounded simultaneously on gongs, chimes, or horns throughout the plant. Upon hearing his call the person wanted steps to the nearest telephone and dials a special number which automatically silences the code signals and connects him to the calling station.

In some instances it may be necessary for an executive to call certain stations frequently. In order to avoid dialing the required number each time, a feature known as executive key-calling service may be installed. This service makes it possible for the calling station to be connected with any one of these stations merely by depressing a key, instead of dialing in the usual way.

Executive right-of-way service may also be obtained with a P.A.X. system. The purpose of this service is to permit a calling station, upon dialing an engaged or busy station, to be connected to the line and interrupt the conversation.

Another feature that conserves the time of important executives is a conference line, which permits a conversation to be held among several stations simultaneously. Each station that is to take part in the discussion is first called in the regular manner and requested to come in on the conference line by dialing the particular number assigned for this service.

If the nature of the plant is such that watchman service is required outside of regular business hours, a special supervisory service may be incorporated, whereby any telephone station can serve as a reporting station by dialing a special number. A permanent record can be made on a recording device installed at a central point, showing the location of each station, and the time at which the report was made.

In planning a P.A.X. installation, one of the first essentials is to determine a central location for the switchboard and lay out a cable wiring system that makes adequate provision for the number of stations to be served immediately, and ample allowance in wire facilities for future growth.

As a general rule it will be found that main distribution cables can be extended from a main cable terminal located at the switchboard to sub-cable terminal boxes installed at central points of the various areas to be served. From these terminal boxes smaller sizes of cable are then extended in different directions to points where open wiring connections can be made to individual groups of telephones.

The type of cable and method of installation are essentially the same as described in the preceding article for a manually operated, selective-talking system. Wiring from the cable terminal boxes to the individual telephones usually consists of twisted-pair wire which may be attached to the walls or baseboards by means of small nails with insulated heads. Or weatherproof, twisted-pair wire may be carried in bridle rings either inside or outside of factory buildings where exposed wiring is permissible.

For convenience in making changes in station locations and installing additional telephones, each cable terminal box should be provided with a cable chart indicating both the cable and telephone number assigned to each line.

At the main cable terminal box separate sets of terminal blocks are provided for the cables connecting to the switchboard and sub-cable terminal boxes. By cross-connections made by means of jumper wire, it is possible to connect any particular line permanently to any telephone number that has not been assigned on the switchboard.

For operation of the system, a power supply consisting of a 48-volt storage battery and a motor-generator set or rectifier for charging is recommended. If desired, the storage battery may be dispensed with and the system operated directly from a battery eliminator connected to a source of 110- or 120-volt alternating current. Except in instances where more than one source of a.c. power is available, however, the storage battery is to be preferred as a source of power supply, since in the event of failure of the primary source of power the need for intercommunicating telephone service is usually an urgent necessity.

Little Maintenance Needed

Figure 3 shows a P.A.X. switchboard and associated terminal apparatus installed in the plant of an automobile manufacturer. Switchboard and cable terminal box are inclosed in metal cabinets. Adjacent to and directly under the clock will be seen the auxiliary units for the watchmen's calling and recording system.

When properly installed a P.A.X. system requires little maintenance other than that needed to compensate for the normal wear and tear to which the outlying station equipment is subjected, and the routine inspection of the switchboard and power supply units recommended by the manufacturers. Contrary to general belief, the circuit details and mechanical operation of the switching units are simple enough to be easily understood, and taken care of, by the average electrician.

There is an Exide-Ironclad Battery ...to fit any size truck

Showing four sizes of Exide-Ironclad cell, including the new Type "MEH" of 1000 ampere-hour capacity. All have been cut away to show interior construction.

THERE is an Exide-Ironclad Battery not only to fit the largest size electric industrial truck, but to drive that truck with power to spare in the hardest and heaviest material handling service for which the truck is fitted. And large, modern battery electric trucks are fitted for really tough jobs. They are available in 30,000 pounds capacity and more.

Down the scale from these giants range the thousands of smaller trucks that have become an indispensable part of industry. For these, in their various capacities, Exide-Ironclads also offer ample power for every job. And in each case, you will find that Exide-Ironclads assure continuity of service, long life, and overall economy that make material handling a low-cost instrument of production.

Why not let these batteries improve your material handling service and cut costs? Write for new edition of free booklet, "The Efficient, Economical Method of Handling Material."

1888 FIFTY YEARS OF ACHIEVEMENT 1938

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia

The World's Largest Manufacturers of Storage Batteries for Every Purpose

Exide Batteries of Canada, Limited, Toronto

You want to know

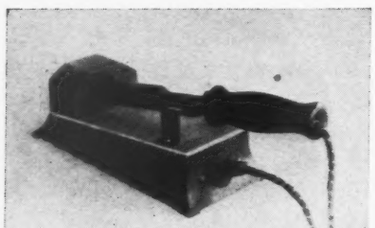
and the editors will gladly tell you more about the things mentioned on this page

• GAGE GLASS has transparent red line, the better to see the water line. With small illuminator placed at the rear, entire tube appears red below water line, making observation quick and certain. (9801)

• LEADERS of government, labor, and management undertook at a recent meeting to lay down a practical program for coordination of the three groups directly involved in today's business picture. What they said is told in a pamphlet. (9802)

• COPPER ALLOY is claimed to be as strong and hard as steel. Made of copper, chromium, and silver, it has high electrical and heat conductivity, heat endurance, and great wear resistance. (9803)

• MAKER of abrasive blasting equipment is all set with a movie to show how his product works. Various types of equipment, for cleaning general and special work in foundry and heat-treating shop, are shown. (9804)



SOLDERING IRON stays at right temperature in this thermostatic control stand. It cuts iron in and out at any selected temperature, has it always ready for use, yet keeps it from overheating. Full current is applied instant iron is removed from the stand. (9823)

• CLEANING TRUCK has places for all cleaning tools, saving steps and preventing accidents from falls over idle brooms and pails. Mops, brushes, brooms, pails, vacuum cleaners, cloths all have their places. (9805)

• TACHOMETER, remote-indicating type, consists of generator and indicator that may be located some distance apart, shows speeds of machines remotely located. (9806)

• TREATMENT colors and dustproofs concrete floors at the same time. It penetrates, seals the pores, prevents absorption of staining materials such as oil and grease. (9807)

• RUBBER LINING for tanks and other containers is "tailored" to the walls in a seamless, smooth finish, and bonded to the metal or wood. (9808)

• FIRE EXTINGUISHERS now come in cans. Can with pump attached holds carbon tetrachloride extinguishing fluid. In case of fire, use nail in handle to puncture holes in both ends, wield the pump. (9809)

• INNOVATION in sheave design brings a split hook to simplify the task of threading ropes and cables. The hook splits open on hinges to let in loop of the rope. (9810)

• CHECK your employment practices on an outline prepared from a survey of successful policies. Vital questions on wages, hours, working conditions, grievances, and other points show you where your company stands. (9811)

• WHEN TO CHANGE crankcase oil is always a moot question. Now appears a simple device which, fed a few drops from the gage stick, helps to determine cleanliness, viscosity, lubricity, and amount of gritty matter in the oil. (9812)

• FINGERS rubbed over a block of a new material become slip-proofed for paper-sorting operations. (9813)

• ODORLESS DEODORANT counteracts odors in lavatories, kitchens, and other odorous places without leaving odor of its own. (9814)

• DRILL AND GRINDER SET comes matched after the fashion of golf clubs. Both tools are small (¼-in. size) but are said to have plenty of power. They come packed in a steel case with carrying handle. (9815)

• WELD SPATTER takes time and costs money to remove. Compound applied by means of a paint brush before welding begins keeps spatter from adhering, makes it possible to wipe or wash the spatter off. (9816)

• LAST FEBRUARY we reported a calculator for determining lens apertures and speeds in photoflood photography. So great was interest in this device, the manufacturer has brought out a daylight calculator. (9817)

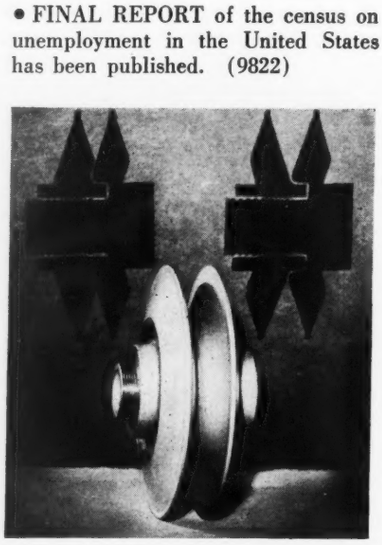
• DESK TRAY, molded of plastic, holds memo sheets, clips, pins, and has pencil rest. It won't burn—just in case you use it for a cigarette rest. (9818)

• PAINT, oil base, can be used on wet or damp walls. It is microscopically porous, it is said, so that moisture can pass through its surface and vaporize. (9819)

• LOTION, removed by washing, protects hands and arms of men coming in contact with soldering and welding fluxes, metal cleaning compounds, and cutting oils. (9820)

• BELTING, round, for light machinery, is made of rubber-like composition material with a center core that ties to join two ends of the belt. Said not to stretch and to have high coefficient of friction. (9821)

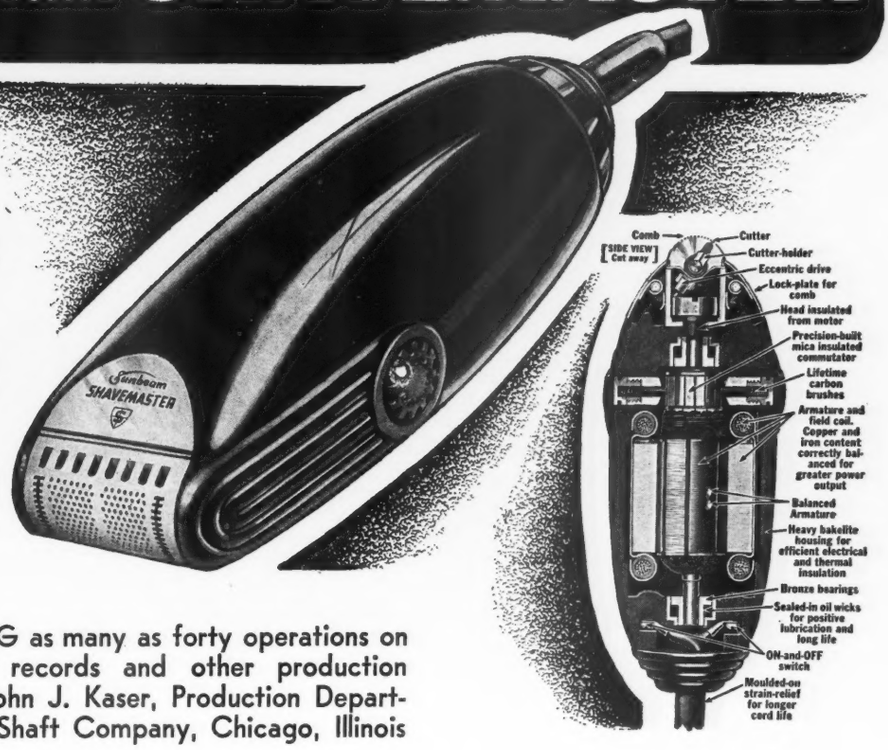
• FINAL REPORT of the census on unemployment in the United States has been published. (9822)



PITCH on this variable-pitch sheave is changed by turning one plate around. With outer plate in position shown at the left, belts ride high, and pitch diameter ranges from 3 to 4 in. Reverse the plate (right), and belts ride low with pitch diameter anywhere from 2 to 3 in. (9824)

McCASKEY *Controls* Aid Production *on the Sunbeam* SHAVEMASTER

REQUIREMENTS AND PRODUCTION SYNCHRONIZED



CONTROLLING as many as forty operations on a part with certified records and other production methods, outlined by John J. Kaser, Production Department, Chicago Flexible Shaft Company, Chicago, Illinois

"Due to the exceptional demand for the SHAVEMASTER and other SUNBEAM electrical products we have increased our manufacturing facilities. This plant expansion with increased production requires a rigid control over work in process.

"We have used McCaskey Controls for our production, costs, and tool cribs since 1921. Extensions have been made several times to parallel the growth of our business.

"In our various shop departments McCaskey provides for the assignment of work to machines or operators. At times as many as five jobs are assigned ahead of each machine or operator. This visible assignment of jobs reduces idle time.

"In our central production office, McCaskey gives us a visible control over all the work in process by piece part numbers and operations. *Some of our part numbers have as many as forty operations.* Instead of posting production figures to ledger sheets or cards, we simply file a copy of our productive labor tickets on McCaskey planning boards.

"This gives us a graphic status of all work in process . . . a continuous check on production by piece part numbers and operations, and an instant check on counts at every operation. Our work-in-process control is constantly up-to-date and errors in posting are eliminated, since we file the original certified record of quantity produced.

"The flexibility of McCaskey Controls has enabled us to take care of our plant and manufacturing expansion with a minimum of additional clerical overhead."

Write for further details concerning this or scores of other equally successful installations and "Simplified Production Control" or pamphlets describing other McCaskey Controls. Your requirements may be radically different, but every McCaskey installation is developed to meet specific conditions. Let us suggest an application to yours. No obligation.

THE McCASKEY REGISTER COMPANY, ALLIANCE, OHIO

McCASKEY INDUSTRIAL CONTROLS

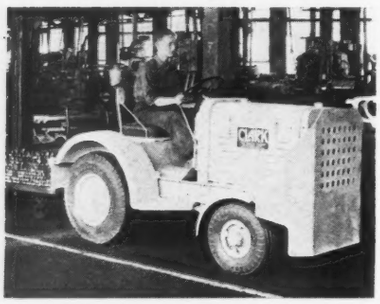
PRODUCTION • INVENTORY • MAINTENANCE • TOOLS • COSTS • PAYROLL

What's New in Equipment

Relay

Type 3-A relay is a sturdy instrument operating at low power input. Its silver contacts, forming a single-pole double-throw switch, handle non-inductive loads up to 150 watts at 110 volts a.c. Requires 12 milliwatts for its operation and is available in various field resistances. It is especially adaptable for use with photo-electric systems. Housed in dustproof metal case 2⅜ in. in diameter and 2¼ in. high. Sigma Instruments, Inc., 388 Trapelo Road, Belmont, Mass.

Tractor



Heavy-duty tractor developing drawbar pull as high as 4,400 lb. is powered by a 6-cylinder, 46-hp. truck-type gas engine, and has self starter, generator, battery, electric horn, removable front bumper plate, heavy removable cast rear fenders, pneumatic tires, hydraulic brakes. Built in three capacities: 3,300, 4,000 and 4,400 lb. Has 59-in. wheelbase, 112-in. turning radius, speed of 11 m.p.h. and will tow 70 to 85 tons on trailers on level roadway. Clark Tructractor, Battle Creek, Mich.

Gasket

"Spirotallic Gaskets" are constructed of preformed plies of asbestos and cold-rolled, cadmium-plated steel for sealing boiler manholes, handholes, and tube plates. Central crimp of the interlocking plies provides the spring action that enables gasket to compress and extend automatically as the gasketing space varies in service. Available in standard sizes in both round and oval form. Johns-Manville, 22 East 40th St., New York.

Chair

Chair has seat and curved back rest made of tempered Masonite. This material has impregnated finish that makes it non-porous and weatherproof; hence the chair can be washed frequently or subjected to exposure in atmosphere laden with moisture or gases. Angle construction makes it strong, and leg braces are double riveted for extra security. Spring steel back rest is adjustable for height. Royal Metal Mfg. Co., 1138-40 South Michigan Ave., Chicago.

Oil and Water Extractor

Designed to keep compressed air lines free from oil and moisture, this oil and water extractor has no moving parts or packing and requires no adjustments. Automatic drain valve prevents accumulation of condensate in reservoir at bottom of extractor shell. Oil and water are collected on a series of baffles in the air stream, deposited in reservoir, and automatically drained off. Sizes are available for 40 and 100 cu.ft. per min. Larger capacities are provided by multiple units. Spray Engineering Co., 153 Central St., Somerville, Mass.

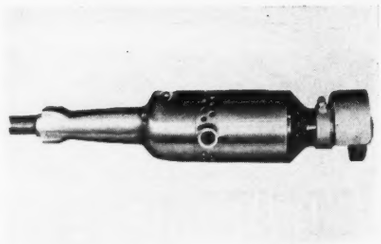
Welding Electrodes

Smootharc "Hartung" electrodes have base metal of tungsten molybdenum wire. This electrode is used for making tool steel cutting edges on medium carbon steel or for rebuilding worn tools and dies. Available in sizes from 3/32 up to ¼ in. diameter, used with currents ranging from 30 to 265 amp. Harnischfeger Corp., 4400 West National Ave., Milwaukee.

Lamp Guard

Heavy-duty, metal portable lamp guard is supported inside and out with a heavy, rubber shock-absorbing ring and handle which prevent vibration and shock being transmitted directly to the lamp. Has a special rubber ring lock which makes it possible to take the guard apart and remove the lamp and reflector without the use of tools. Handle and ring are made of oil- and heat-resistant latex rubber. Safeguard Electric Co., Inc., 1 DeKalb Ave., Brooklyn, N. Y.

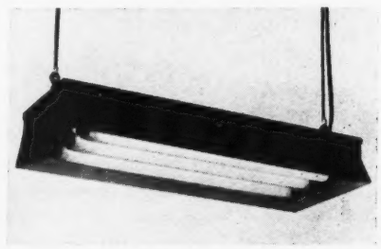
Portable Grinders



Two high-speed portable grinders have wheel size capacities of 2 and 2½ in. They have a no-load speed of 19,000 r.p.m., overall length of 13½ in., and weigh 3½ and 4½ lb., respectively. The Black & Decker Mfg. Co., Towson, Md.

Fluorescent Lighting Fixture

Model FL-324 fluorescent tube lighting fixture uses three 24-in. daylight fluorescent tubes. This light closely approaches average daylight in quality and is said to be an excellent source of light for color grading. Fixture can also be supplied with white fluorescent tubes



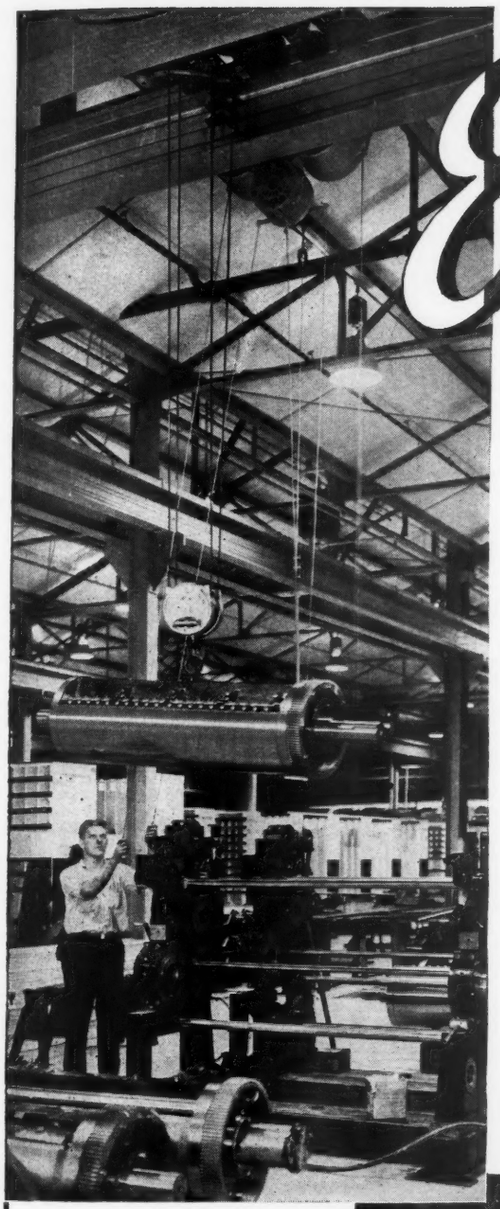
that provide light approaching that of regular incandescent lamps. Complete unit measures 28x11½x4¼ in. Can be operated on single-phase, 110-volt, 60-cycle supply or on a 3-phase, 220-volt, 60-cycle supply. Rated at 80 watts. Barkon-Frink Tube Lighting Corp., 23-10 Bridge Plaza South, Long Island City, N. Y.

Valves

"Murray-Lorge" automatic shut-off valve is placed in supply line above flexible hose used to convey compressed air. steam, gas, or fluids under pressure. It immediately shuts off supply when there is a break in the hose or the hose becomes disconnected. Plunger may be adjusted to shut off flow at any desired pressure at inlet. D. J. Murray Mfg. Co., Wausau, Wis.

Controllers

Line of d.c. heavy-duty controllers for heavy-duty applications below 10 hp. and general purpose above 10 hp. Timing device gives definite time acceleration



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...Economically...

With Type H Mercury Lamps

"Eyes Right" is the first command in planning for modern industrial operations. Executives know that *good seeing,* night and day, is a prerequisite to good workmanship . . . that it aids accuracy, cuts accidents and ends the nervous tension that comes from eye fatigue.

Today, when the problem is to insure good seeing without a high premium in energy costs, there's an equally clear-cut command for the higher light output of General Electric Type H Mercury Lamps. Dollar for dollar, these high-efficiency light sources furnish brighter, safer seeing conditions, which provide greater eye comfort and clarity of fine detail.

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GENERAL ELECTRIC

896H

General Electric Vapor Lamp Co.
815 Adams Street, Hoboken, N. J.

Incandescent Lamp Department
Dept. 165, Nela Park, Cleveland, Ohio

The 400-Watt Type H Mercury Lamp has a higher light output per watt than any other light source practical in industry. Its rated operating life is 2,000 hours.

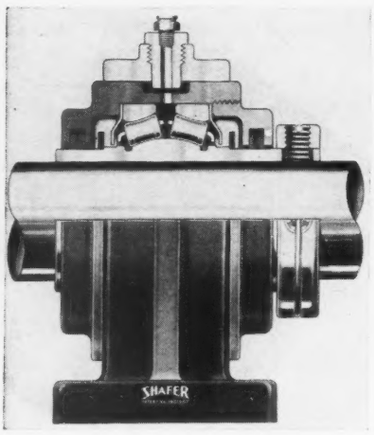
The General Electric auto-transformer has been designed specifically for use with the General Electric Mercury Lamp. Order this auxiliary equipment from the General Electric Vapor Lamp Company.

unaffected by load, temperature, or other working conditions. Come in non-reversing and reversing types, with and without dynamic braking, for both constant-speed and adjustable-speed motors. Available for use with either push-button or drum-type master switch, and in all ratings up to 75 hp., 115 volts, and 150 hp., 230 and 550 volts. Cutler-Hammer, Inc., 253 North 12th St., Milwaukee.

Hoist

"Suspended Seat Hoist Carrier" is a one-man-operated hoist for piling kegs, drums, bales, lumber, sheets, etc. in high storage banks. Consists of hoist and cab for the operator. Cab goes up and down with the load, so that operator is always opposite the load. He can lower himself to floor level to attach sling to the load, and he can step from cab onto the pile to detach load when it is in place. This makes stacking a one-man operation. Cleveland Tramrail San Francisco Co., 82 Barle St., San Francisco.

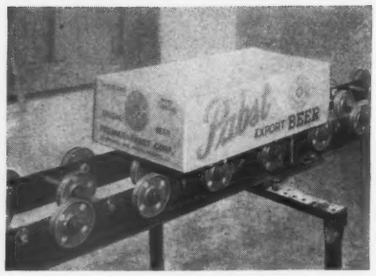
Pillow Blocks



Pillow blocks for heavy-duty services have welded steel housing construction and are sealed against unusually severe dirt conditions. Double row self-aligning roller bearing is mounted in cartridge housing containing the three sealing members. Bases are machined and are of 4-bolt type. Concave roller bearing design provides self-alignment and capacity for radial or thrust load. In shaft sizes from 1-7/16 to 3-15/16 in. Shafer Bearing Corp., 35 East Wacker Drive, Chicago.

Conveyor

Knock-down-type conveyor is available in convenient sectional lengths for quick, easy installation when and where needed. Sections are straight and curved, and equipped with simple coupling devices. All-metal "horse" supports complete the equipment. Has staggered arrangement of three rows of wheels, two wheels mounted on the outside frame of the conveyor and the center wheel mounted on a through axle, offset between the two outer rows, providing the carrying effect of closely spaced wheels. Cartons and cases as short as 12 in. in length may be



carried on the conveyor with wheels spaced at 6-in. centers. Said to be particularly useful for handling cases or cartons from storage to trucks and vice versa. Standard Conveyor Co., North St. Paul, Minn.

Electric Soldering Tool

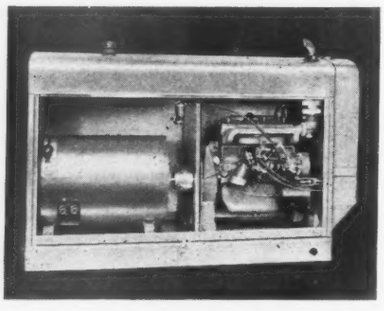
"Handy" electric soldering tool is designed for light, delicate work such as on telephones, small motors, and instruments. It is 6½ in. long by 7/16 in. in diameter. Consists of a handle with two heating carbons, one fixed, the other movable against the spring. When both carbons contact metal, an electric circuit is closed and the metal reaches soldering temperature almost instantly. Having one carbon movable against light spring pressure makes soldering on uneven surfaces easy. Ideal Commutator Dresser Co., 1416 Park Ave., Sycamore, Ill.

Barrel-Inspection Lamp

Type EVBL explosion-proof barrel-inspection lamp can be inserted into bung holes 2¼ in. in diameter and larger. Overall length is approximately 32 in. and handle unit is a long ½-in. pipe. Safety grounding circuit is carried through an extra pole in handle unit. Uses a 25-watt clear lamp. Appleton Electric Co., 1701-29 Wellington Ave., Chicago.

Arc Welder

P&H-Hansen 200-amp. "Special" engine-driven welder has a 200-amp., 30-volt, 6-kw. generator with an intermittent welding range of 35-225 amp. Generator



is connected by flexible coupling to 24-hp. 4-cylinder watercooled gasoline engine. Engine is equipped for hand starting and with magneto ignition system. Entire unit is mounted on a formed steel base and equipped with an inclosing sheet metal canopy. Handles electrodes up to 7/32 in. in diameter under continuous manual operation. Harnischfeger Corp., 4400 West National Ave., Milwaukee.

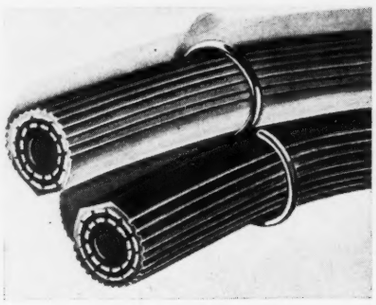
Regulator

Model 38 regulator for reducing and stabilizing air pressures is very small in size. No. 38S has ¼-in. female-pipe-thread side inlet and outlet. No. 38R has ¼-in. male-pipe-thread rear inlet and ¼-in. female-pipe-thread side outlet. Gages may be installed, and a double outlet may be provided if needed. Pipe thread connections of ⅛ in. can be had. C. H. Dockson Co., 2885 East Grand Blvd., Detroit.

Tachometer

No. 50 O-Z improved hand tachometer shows revolutions per minute, peripheral speed, speed variations. Has total range from 40 to 50,000 r.p.m. and peripheral speed range from 12 to 15,000 ft. per min. There are three ranges, all read on the single scale. Has fixed reading device controlled by a pushbutton, for fixing hand at indicated speed. O. Zernickow Co., 15 Park Row, New York.

Welding Hose



"Thermoid Double Weld Hose" contains two equal lengths of hose, one with a red cover and one with a green cover, bonded together to form a single unit. For attaching to separated fittings, double hose may be split into separate hoses for any required distance. Splitting beyond the desired point is prevented by special clip. Designed for welding and cutting equipment, it is just as flexible as ordinary welding hose. Thermoid Rubber Division of Thermoid Co., Trenton, N. J.

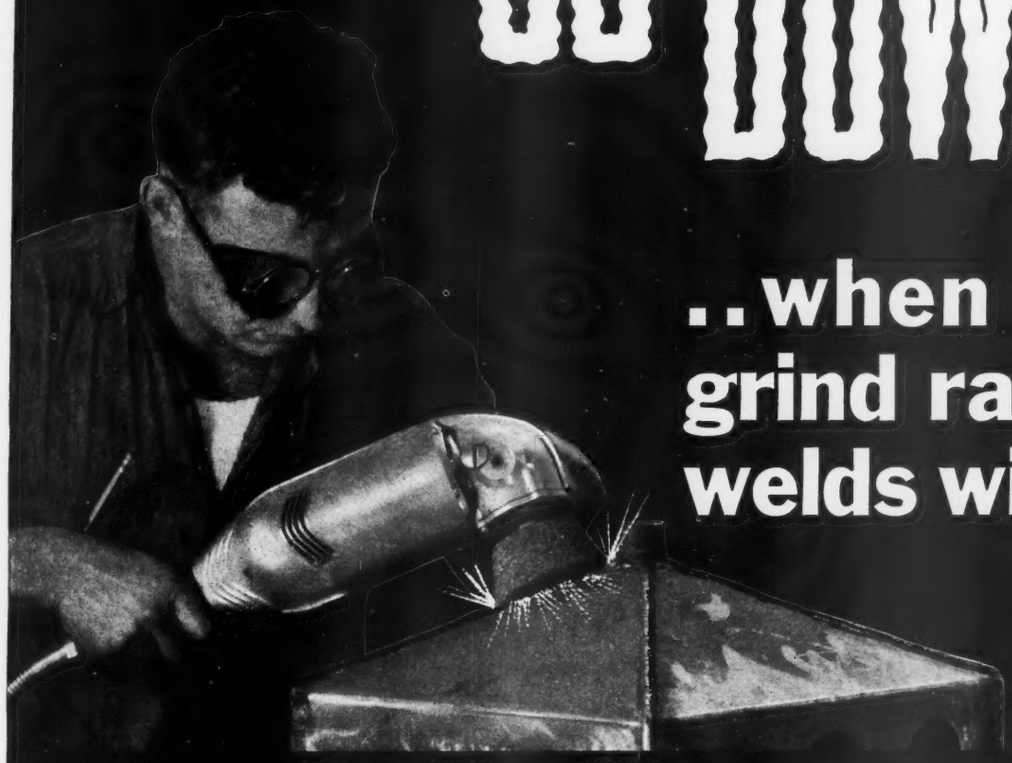
Valve Disk

All-purpose disk for valves handling air, gas, steam, and liquids at any temperature or pressure, for acids, alkalis, or solvents, is of laminated construction, built up of alternating layers of asbestos and metal completely incased in a two-piece shell of copper, Monel, or other alloy metal. Shell protects the laminated parts and affords flat seating surfaces, both top and bottom. Made in sizes for ¼- to 12-in. valves with round or oblong holes. Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.

Screwdriving Machine

Portable screwdriving and nut setting machine comes in two assemblies. Assembly X is mounted on a heavy 4-caster base and can be easily moved about. Assembly Y is of the suspended type. Counter-balanced swivel arm allows oper-

COSTS GO DOWN!



..when you grind raised welds with..

SKILSAW DISC SANDERS

●Try them on your toughest weld grinding or cleaning work . . . and you'll find that SKILSAW Disc Sanders will not only save you considerable time and labor, but will do the job better and easier! Use SKILSAW Disc Sander with cup grinding wheels (up to 6 in. diam.) and watch the spot and raised welds just melt away before its rush of grinding power that leaves the surface as smooth and clean as you want it. Made in 3 models, for use with grinding wheels, wire brushes, polishing pads, etc. on flat, concave and convex surfaces of metal, wood, stone, marble, tile and composition.

SKILSAW, INC.
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●*Sold by leading distributors of mine, mill, hardware and contractors' supplies.*

3 MODELS ...a size to fit every need!

SKILSAW
PORTABLE ELECTRIC TOOLS
SAVE MONEY IN EVERY INDUSTRY!
• SAWS • DRILLS • BELT SANDERS • DISC SANDERS • GRINDERS • BLOWERS •

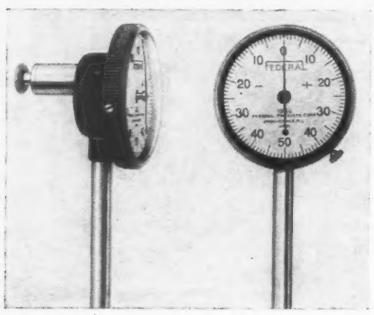
ator to cover a large area and eliminates weight of shaft from operator's hand. Screws and nuts may be driven to any desired tension by merely tightening the belt. Five models provide range in capacities from No. 10 to ½-in. screws and nuts. Machines can be furnished with special pulleys to give special speeds. Motors can be furnished for any electrical specifications. Stow Mfg. Co., Inc., Binghamton, N. Y.

Pushbutton Station

Heavy-duty Type HD pushbutton station suitable for use in corrosive atmospheres and in Class I Group D hazardous locations. Explosion proof either with or without oil in the station. Available with from one to four standard pushbutton units of momentary-contact type, or with maintained-contact units. Available with two- or three-position selector switches which can be had either as single-pole, double-throw switches or double-pole, single-throw switches. Westinghouse Electric & Mfg. Co., East Pittsburgh.

Indicator

V-8-I indicator is the perpendicular-spindle type, has its contact point perpendicular to the face of the dial. It is an improved type with a crown gear



replacing the spiral used in earlier models to change direction of gear movement. This is said to result in a more sensitive and more accurate indicator. Has range of 0.100 in. and is graduated in 0.001 in. Federal Products Corp., 1144 Eddy St., Providence, R. I.

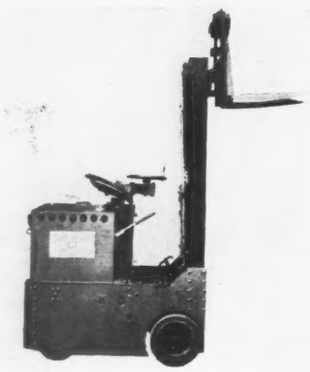
Jacks

Five raising and lowering jacks. Nos. 84A, 85A, and 86A are 5-ton jacks which supersede the company's 84, 85 and 86 jacks. They are said to have stronger cadmium-plated springs and links, shorter fulcrum centers, longer and wider rack bar toe lifts, larger trunnion bearings, and larger and stronger pawls. No. 1017 is a light-weight 10-ton jack for low loads. No. 24A is a 15-ton jack superseding the No. 24. It is said to be more rugged than the earlier model. Templeton, Kenly & Co., 1020 South Central Ave., Chicago.

Duplicating Machine

"Master Model Standard Fluid Process Duplicator" has simplified automatic feed. Copy sheet is fed forward by knee-action feed assembly and a stripper head allows just one sheet to feed forward at a time. Feed handles form sizes 5x8 to 9x14, and is easily attached or detached from the machine; it will feed copies at a rate of 40 to 50 per min. Has supply cabinet which serves as a stand for the duplicator and as a storage place for supply items. Is made of heavy steel construction with a two-tone black, fluid-resisting finish trimmed with chromium. Available in sizes 9x14, 12x14, 18x14, both hand and electrically operated. Duplicating Machines Division, Standard Mailing Machines Co., Everett, Mass.

Lift Truck



"Bantam" power lift truck is designed for moving and stocking raw or finished material on platforms, pallets, dollies, tote-boxes, etc. Overall length of truck with 24-in. forks is 72 in. and overall width is 26 in. With 90-deg. swing of trailing wheels truck will turn in a complete circle of 94 in. diameter, thereby permitting operation in 42-in. wide intersecting aisle. Normal capacity of 1,000 pounds on forks. Powered by two railway-type motors for traction and lift operations. Wright-Hibbard Industrial Electric Truck Co., Inc., Phelps, N. Y.

Thermal Overload Relays

Bulletin 7322 thermal overload relays for 600 volts maximum are designed to provide overload protection for a.c. motors. They are used as an auxiliary device to open the pilot circuit of a magnetic starter or controller. Inverse time protection with delayed trip permits high starting inrush currents. Designed for heavy-duty service. Thermal mechanism is inclosed to eliminate effect of stray air currents. Relays are front-connected, but can be supplied as a back-connected type if desired. The Clark Controller Co., 1146 East 152d St., Cleveland.

Time Meter

"Timeter" is an electrically operated counter for automatically registering the total number of hours that any electrical device or motor-driven machine has been in operation. A small, slow-speed self-starting synchronous motor drives a set of numbered wheels through a gear train. It is connected directly across terminals of any a.c. device of the same voltage and frequency rating. Can be supplied with relay for special applications. Rated 100-125 volts, 60 cycles, 2 watts. Records in hours and can be supplied to read in minutes and tenths. National Instrument Co., 44 School St., Boston, Mass.

Time-Cycle Controller

Model 536 is a two-speed controller utilizing varied speeds on a single camshaft. In recycling operations, motors of different speeds are placed at either end of the camshaft, and, utilizing speed reducers and over-riding clutches at proper places on the shaft, the cycling operation is accelerated or slowed at any point desired in the cycle. The acceleration and deceleration may be completely automatic, controlled by a mercury switch operated by one cam, or controlled by pushbutton. Electric Switch Corp., Columbus, Ind.

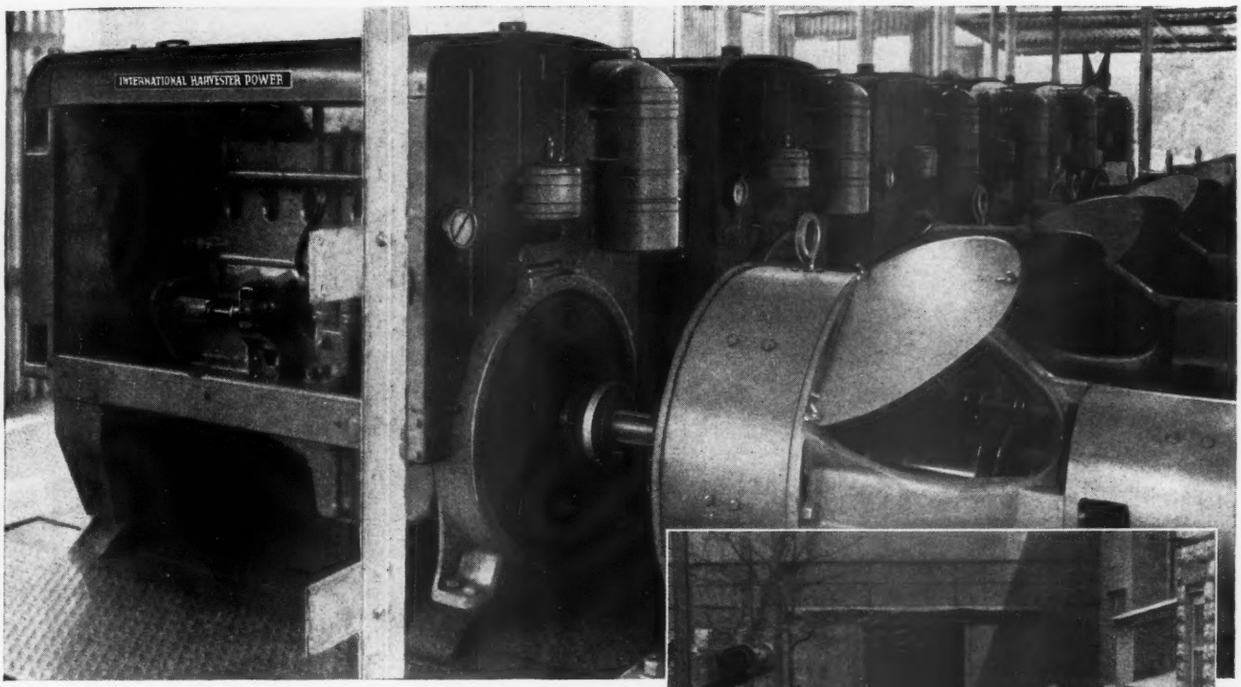
Bandsaws

Two bandsaws, 14- and 16-in., are additions to the company's "W" line. Frame is cast in one piece and wheel guards are hinged to it. A dust chute is built in as an integral part of the frame. Table tilts 45 deg. right and 5 deg. left of the cutting line. Easily read dial indicates the angle of tilt. Blade is completely guarded. Available as bench or floor model with belted motor or belt drive. Yates-American Machine Co., Beloit, Wis.

Roller Conveyor

Employs three types of bearings and can be gravity or power driven. Commercial line for normal service has rollers ranging 1 to 4½ in. in diameter, while precision line for medium or heavy duty has rollers from 2⅛ to 7⅝ in. in diameter. Ten-foot length is standard, but conveyor can be supplied in any length to suit requirements. Bearing seals and bearing adaptors are provided to meet all types of operating conditions and all sizes of tubes. Frame rails can be angle, channel, or flat-bar construc-

Let International Power Units *Cut Your Power Costs*



Six International Model PA-100 Power Units direct-connected to generators. Multiple hook-ups of two or more International Power Units solve many power problems. They can be cut in or out as power requirements vary.

The power of International Harvester Engines is available to industry in gasoline, gas, and Diesel power units ranging up to 110 max. h.p. These units are used singly or in batteries to provide power for a surprising variety of jobs.

Owners in many industries report that these compact, efficient units give them maximum performance for every power dollar invested. This is language that every business man understands. The wide range of sizes permits the selection of International Power Units for efficient work on any power job. Where loads vary widely, two or more units can be installed.

When costs pinch profits in your business, *look to your power.* Ask the nearest International Power dealer or Company-owned branch to analyze your problem and show you how International Power will reduce your operating costs. A post card will bring full details concerning International Power Units or any of the wheel-type or crawler tractors in the complete International Industrial Power line.

This International-powered locomotive keeps materials on the move in a modern manufacturing plant.

INTERNATIONAL HARVESTER COMPANY
(Incorporated)
180 North Michigan Avenue **Chicago, Illinois**

INTERNATIONAL Industrial Power

tion. Bearings can be had dry, grease-packed, or fitted with lubrication fittings for pressure grease gun. Palmer-Bee Co., Detroit.

Circulating Pump

P-54 unit is a self-contained fluid circulating pump, operated by electric motor or by air motor drive. Delivers clear lacquer and varnish and other non-pigmented finishing materials from the original shipping container to the spray gun. Can be changed from one gun to another in a few seconds. Pump, relief valve and fluid feed regulator are mounted on a steel base plate which may be secured to top of drum or attached to brackets fastened to wall above the drum. Binks Mfg. Co., 3114-40 Carroll Ave., Chicago.

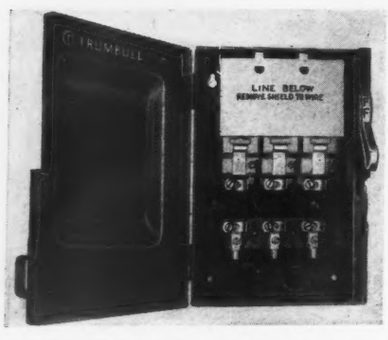
Valves

Bronze Mounted and All-Iron U-bolt Gate Valves are said to be easily disassembled for inspection or repair and have high resistance to springing and distortion. Have "bonnet-saver-bushing" that makes it unnecessary to junk the valve bonnet when operating threads are worn. By slipping a new "bonnet-saver-bushing" into position, user obtains good-as-new thread engagement in the same old bonnet. Jenkins Bros., 80 White St., New York.

Welding Electrode

"Fleetweld No. 9 HT" welding electrode for use on pressure vessels of high tensile steel. Designed for welding steels of 70,000 to 80,000 lb. per sq. in. tensile strength. It produces a weld metal that has high strength and creep resistance at elevated temperatures, it is said. Operates with a.c. or d.c. but is for welding in a down or flat position only. Made in 18-in. lengths in 3/16- and ¼-in. sizes. The Lincoln Electric Co., Cleveland.

Switch



Type RBA heavy-duty inclosed safety switch has interior mounted on a removable saddle with all terminals accessible from the front. Has operating handle combining advantages of front and side operation. Has wiring gutters and solderless connectors. Rated 30 to 600 amp., 2 and 3 pole, 230 to 575 volts a.c., 250 to 600 volts d.c.; fusible and no fuse. The Trumbull Electric Mfg. Co., Plainville, Conn.

Portable Elevator

Model PBRT portable elevator has travel wheels that are retractable when the elevator is in position, so that weight can be transferred through four other wheels to a circular plate on which the unit can be rotated. Load capacity is 1,500 lb. Platform can be elevated to 133 in. above the floor or lowered to within 8½ in. Platform is 48 in. long, 42 in. wide. Safety devices include thermal-overload switch, solenoid brakes which apply brake immediately when the power is off, slack-cable switch, and a limit-stop switch. Lewis-Shepard Sales Corp., 245 Walnut St., Watertown, Mass.

Gas Masks

Full-vision gas masks Nos. 4 and 4A for organic vapors. Full-vision safety glass lenses permit wearer to see the same as when not wearing a mask, it is said. Dead air check valves automatically open and close upon inhalation and exhalation, preventing accumulation of exhaled breath in fresh air ducts. All-rubber facepiece is light in weight. No. 4A has 27-in.

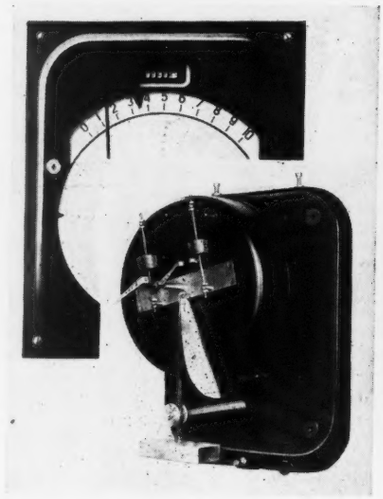
flexible hose and carrier. No. 4 is of front-lace carrier type with 10-in. flexible corrugated hose. Acme Protection Equipment Co., Inc., 3633 Liberty Ave., Pittsburgh.

Exhaust Fan

Type JG exhaust fan is designed to remove rapidly large volumes of air wherever a general vapor fume or dust condition prevails. Can be installed at window, wall, or ceiling openings. Available with ¼- or ½-hp. direct-connected electric motors. The ½-hp. motor turns a four-bladed fan 1,725 r.p.m. to move 6,350 cu.ft. per min.; two-bladed fan on the ¼-hp. motor removes 5,250 cu.ft. per min. at the same r.p.m. Blades are air foil type, made of highly polished aluminum. The DeVilbiss Co., Toledo, Ohio.

Flow Meter

"Ring-Balance Flow Meter" for low-pressure gas measurement is designed for operating differentials as low as 2 in. of water. Consists of ring-shaped body rotably supported on knife edges at its center, so as to be capable of turning



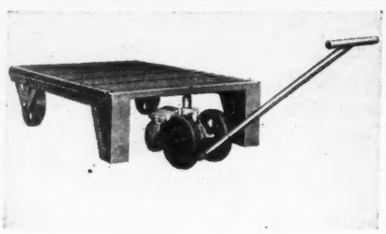
freely. The annular body is partly filled with water, oil, or air anti-freeze liquid, and is divided at the top by a partition wall, to each side of which a flexible tube is led for the purpose of subjecting the unit to the differential pressure from an orifice or flow nozzle through which flow is to be measured. Cochrane Corp., Philadelphia.

Relay

Type L twin-latch relay carries loads up to 30 amp. a.c. and 10 amp. d.c., and requires 8 watts for operation. Is adapted for 3-wire thermostatic control systems and for operation where circuits are closed with extremely light pressure. Meets electrical code requirements up to 250 volts. G-M Laboratories, Inc., Dept. NR, 1731 Belmont, Chicago.

Truck

"Skid-Jack" is a semi-live skid and a wheeled jack or lifting unit. Skids are made of steel or all-steel-bound hardwood decks, in various sizes and capacities ranging from 1,200 to 5,000 lb. Choice of wheel sizes from 7 to 12 in. in diameter. Jack operates with single stroke of the handle. When handle reaches its low point, union of jack and skid is auto-

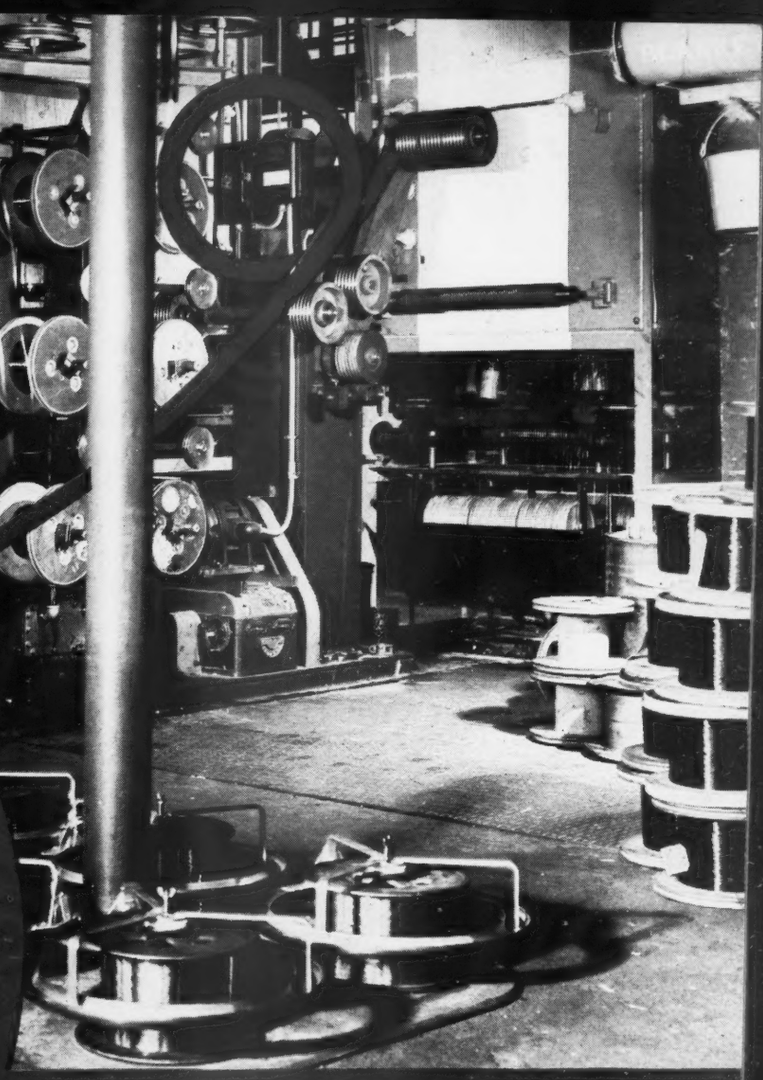


matically locked and load is off the handle. Load is lowered with a pedal release. Spring handle hold-up keeps handle erect at all times when truck is idle. Service Caster & Truck Co., 505 North Brownswood Ave., Albion, Mich.

Circuit Breaker

Type U De-ion air circuit breakers are 2,500- and 5,000-volt breakers completing a line of medium-capacity indoor breakers with interrupting capacity

Mr. R. W. Mungall, Production Engineer of a large wire and cable plant



LOST

6¾ MILES WIRE PRODUCTION WITH EVERY SHUTDOWN

—So Mr. Mungall Chose G-E Control with Isothermic Protection for this Wire-enameling Machine

OVER the spools of this wire-enameling machine—through the enamel baths, into the oven, and on to delivery reels—travels tiny copper wire.

Even the briefest shutdown of the drive motor would result in overbaking of the enamel on half a mile of wire.

Not only would this wire be ruined, but the time consumed in removing it and restarting normal production would be sufficient for producing almost seven miles of wire.

Obviously, continuous operation of the drive motor is important—that's why the engineers chose a G-E motor starter (a CR7006-D40) to control and protect it.

The isothermic overload protection provided in the D40 keeps a motor in operation unless it becomes harmfully overheated. That's why more and more plant engineers are specifying G-E isothermic control for their important drives. General Electric, Schenectady, N.Y.

GENERAL ELECTRIC

WHICH G-E MOTOR STARTER WOULD YOU CHOOSE?

1 One of the complete line of magnetic full-voltage starters

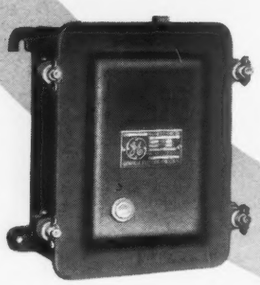
2 Magnetic reversing with overload protection provided in this starter

3 Save installation time with this combination manual disconnect and magnetic starter

4 The autotransformer in this widely used manual compensator minimizes line disturbances in starting

5 The cast-iron enclosure of this starter makes it suitable for hazardous locations

6 Dust cannot affect the operation of this starter, because of its tight, gasketed enclosure



7 Here's a weatherproof and splashproof enclosure for outdoor applications

All Have Isothermic Overload Protection

ALMOST every motor-starting job presents distinct requirements—current capacity, enclosure, starting current, line protection.

There's a G-E starter that fulfills every one of your requirements. And with each starter is an extra feature—isothermic overload protection which protects both your motor and your production schedule.

The starters are designed and built to provide the longest life and best performance—they all have long-lived contacts, efficient magnetic parts, and trouble-preventing layer-wound coils.

Fill out the coupon *now* for information on the motor starter you would choose. General Electric, Schenectady, N. Y.

General Electric Co., Dept. 6B-201
Schenectady, N. Y.

Please send me information on the following motor starters shown on this page:

1 2 3 4 5

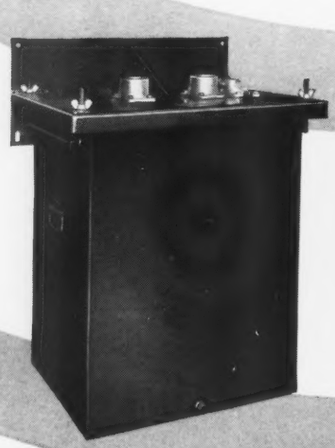
6 7 8 9

Name .....

Firm .....

Address .....

080 164



8 Wall-mounted, 2300-volt, full-voltage, oil-immersed starter saves space by its compactness

9 This oil-immersed, magnetic, reduced-voltage starter is for corrosive atmospheres

GENERAL ELECTRIC

COSTS *were sawed* IN HALF!

For an outlay of $85.00, the Shell representative showed this company how to cut costs in half

ELECTRICITY for the entire 5-acre Hutton & Bourbonnais Co. plant in Hickory, North Carolina, is generated by means of a 550-H. P. compound steam engine.

The mill had experienced great difficulty in lubricating this engine and decided to call in a Shell representative to work on the problem.

The Shell man went to work . . . made a survey of operating conditions . . . saw where the trouble lay. "You can lick this trouble for about $85.00," he said. That $85.00 was an investment in new equipment for the engine. "Couple that equipment with the right grade Shell Wolco Oil 79J for this application . . . and we'll have the answer," was the engineer's prediction.

The new system and lubricant were put in use and found satisfactory in every respect. According to Mr. G. N. Hutton: "Through the expenditure of about $85.00 for recommended equipment, we have been able to cut down our steam-cylinder oil expense by about 56 per cent."

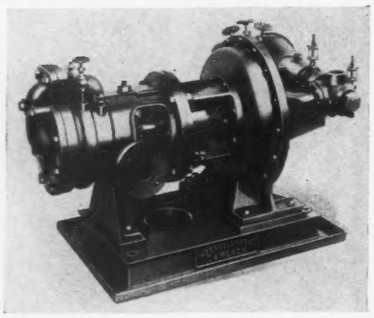
• • •

The outstanding job done by the Shell man for this mill is being repeated day after day in mills, mines and factories all over the country. When faced with a tough problem of industrial lubrication, *call on the men who get results!* Simply phone or write your nearest Shell office.

SHELL INDUSTRIAL LUBRICANTS

ratings from 75,000 to 500,000 kva. for 25 or 60 cycles or other commercial frequencies. They operate in air and are designed to give low operating costs. High-speed arc control, arc resisting contacts, solenoid operation, universal mounting arrangements are among the features. Westinghouse Electric & Mfg. Co., East Pittsburgh.

Pump



Class TRV pump is a turbine driven pump combining both turbine and pump on a common shaft. Single-stage sizes for capacities from 5 to 1,000 gal. per min. against heads as high as 220 ft.: two-stage sizes for capacities to 275 gal. per min. and heads up to 550 ft. Horsepower used is 5 to 40. May be operated on steam or air. May be bolted to floor, wall, tank, column, or ceiling. Ingersoll-Rand Co., 11 Broadway, New York.

Floodlight

"Alzo-Lite" is a medium-spread-type floodlight made of aluminum, suitable for floodlighting yards. Designed for use with 750-, 1,000-, and 1,500-watt lamps. Has symmetrical beam with spread of approximately 65 deg. Is weatherproof, and various styles of mounting bracket are available. Benjamin Electric Mfg. Co., Des Plaines, Ill.

Showers

Sectional receptors make the company's circular "Multi-Stall" showers completely self-contained, permitting installation on any type of floor. No floor work is required aside from setting the single drain. They minimize splash between compartments and outside the shower, and increase safety by means of an anti-skid standing surface. Constructed of precast stone reinforced with steel. In wid.h they conform to the dimensions of the individual shower compartments but in length extend approximately 6 in. beyond the diameter of the fixture proper. They are 5 in. deep with a ½ in. pitch. Bradley Washfountain Co., North 22d and West Michigan Sts., Milwaukee.

Welders

Three welders: Model 15 has current range of 115 to 125 amp., operates on either 110 or 220 volts, single-phase, 60-cycle a.c. Mounted on rubber-wheeled casters and provided with handles for carrying. Model 25 has ampere range of 20 to 180, operates on 240 or 480 volts, single-phase 60-cycle a.c. Model 35 is rated 20 to 75 amp., operates on 240 or 480 volts, single-phase, 60-cycle a.c.; also available in higher ampere ratings. Glenn-Roberts Co., Inc., 1009 Fruitvale Ave., Oakland, Calif.

Controller

Air-operated cycle controller provides for the control of as many as four separate operations. The single cam is designed to be cut so that it will meet a wide variety of requirements and additional flexibility is provided through the use of adjustable segments. Equipped with three-way leakless pilot valves. Cases are moisture and dustproof and the switches that control the electrical circuits and controller are inclosed, as is the motor. The Bristol Co., Waterbury, Conn.

Micrometer

"Compar" is an indicating micrometer and comparator containing no gears or racks in the indicator mechanism. Knife-edge lever type is used, which eliminates uncertainty of measuring feel since it includes a feature which makes measuring pressure visible. There is no anvil relieving button that moves back the lower anvil for inserting and removing work. When work is inserted and button is released, the anvil is pressed against the work by a light-pressure return spring. Thus, no matter who does the measuring, the reading is sure to be the same, for measuring feel does not enter into it. Measures in 0.0001 in. George Schell Co., 128 Lafayette St., New York.

Humidifier

Type C humidifier can be fitted into warm air chambers, ducts, and cabinets. It is 4 in. wide by 3 in. deep, and can be made in lengths 20, 30 and 40 in. "Automatic Water Tender" takes cleanest water off top of pipe and conveys it through 10 ft. of heavy-wall copper tubing, accurately controlling water level. Welded steel evaporating pan has its edges turned in for strength, rigidity, and ease of removing sediment. To eliminate any possibility of rust or electrolytic corrosion, the pan is protected with two coats of acid-resisting porcelain enamel. Increased capacity can be obtained by heating either air or water or both, or it can be increased by absorbent evaporator plates, suspended from racks. The Air Conditioning Supply Co., 4060 Superior Ave., Cleveland.

Valve

"Stream-Flow" is a packless, cylindrical gate valve, suitable for high as well as low pressures and temperatures. Body carries cylindrical bore at right angles to line of flow. A cylindrical gage is moved up and down by means of a screw in the valve bonnet, and is prevented from turning by a key in the cylindrical bore. Cap on bottom of the body and the removable bonnet permit cleaning the valve while it is in the line. Sizes range from ½ to 8 in. in standard metals. Can also be had in special metals and alloys for lines handling corrosive liquids and gases. Monat Valve & Forge Co., 958 Bessemer Bldg., Pittsburgh.

Starters

Two starters. Bulletin 2851 is a manual across-the-line-type starter and protective switch having thermal overload protection and pushbutton. Depression in cover of the steel inclosure prevents accidental contact. Silver-to-silver, butt-type contacts. Bulletin 4002 is an a.c. automatic across-the-line starter for non-reversing service. Provides thermal overload protection, pushbutton operation, and a three-position selector switch in the cover. Ward Leonard Electric Co., Mount Vernon, N. Y.

MASTER
UNI-BRAKE MOTORS

- **STOP QUICKLY**—save time, speed up production, lower costs with a compact, integral unit.
- **STOP FOR POSITION** at the desired point for quickly and conveniently loading and unloading.
- **STOP AND HOLD** any load—advantageous on elevators, hoists, inclined conveyors, etc.
- **STOP FOR SAFETY**—reduce the hazard of injury to operator or damage to equipment.
- **EASILY ADJUSTABLE** with an externally operated mechanism.
- **A COMPLETE LINE**—1/10 to 100 Horsepower.

THE MASTER ELECTRIC COMPANY

DAYTON, OHIO

Operating Shorts

Slide Rule Shows Indirect Expense Allowances

E. C. Schenker
Time Study, Methods, and Cost Division, Colonial Radio Corporation Buffalo, N. Y.

Our foremen have special slide rules from which, knowing the approximate number of productive employees they will require in a particular week, they can determine what allowances they will have for indirect expenses, the items going to make up overhead.

The foremen are vitally interested in these budget figures, for they are paid a bonus when indirect costs are less than the budgeted allowance. Their salaries are increased by the same percentage as the percentage savings. The formula we use is:

$$\frac{\text{Dollars Saved X Salary}}{\text{Total Weekly Allowance}} = \text{Bonus}$$

To use the slide rule, the foremen have only to slide it to the top line figure corresponding to the number of direct-labor employees they expect to need the following week. Then they simply read off the allowance for the eight items of indirect cost and the total indirect allowance (bottom line). The rule shown in the sketch, for example, is set to show allowance for 40 employees.

Made constantly conscious of indirect labor expenses in this way, the foremen watch each item carefully to make savings wherever possible. If expenses in any single budget item exceed allowance, a check is made, and an adjustment in work distribution effected if warranted.

Allowances were determined by totaling expenses for these budget items over a six month's period, apportioning them on a "cost per direct operator" basis, then multiplying to establish units of 15, 20, 25, etc. direct-labor employees. Revision of the figures is made every six or twelve months.

We make the slide rules of celluloid, put the figures on with India ink.

Two elevators removing cases from a conveyor line at W. & A. Gilbey, Ltd., plant of National Distillers Products Corporation, Cincinnati, used to jam when imperfect cases stuck and caused other cases to pile up behind them. Photoelectric controls now shut the elevators down as soon as a case gets in trouble, preventing a jam.

Combined Fuse Puller and Tester Makes for Safety

John A. Honegger, *Bloomfield, N. J.*

After several electricians in our maintenance department nearly electrocuted themselves while removing 60-amp. fuses from panelboards, we designed the combination fuse puller and tester shown in the drawing. Six were made up, and all the parts were either cut out on a bandsaw or made in a lathe.

The device consists of the fiber handle, *1*, and the round-section handle, *2*. To the latter is fastened the tong end, *3*, which is held in the slot of handle *1*, and fastened in place by rivets *9*. At *4* and *5* are two other tong ends fastened to handle *1* by rivets *8*. Between tong ends *4* and *5* a fiber spacer is inserted and held in place by two rivets, *7*. Both of these handle and tong assemblies are pivoted at *6*.

By opening the tong jaws sufficiently they can be placed around a cartridge fuse of any ordinary size, and since the various parts are nonconducting there is no possibility of shock when removing it.

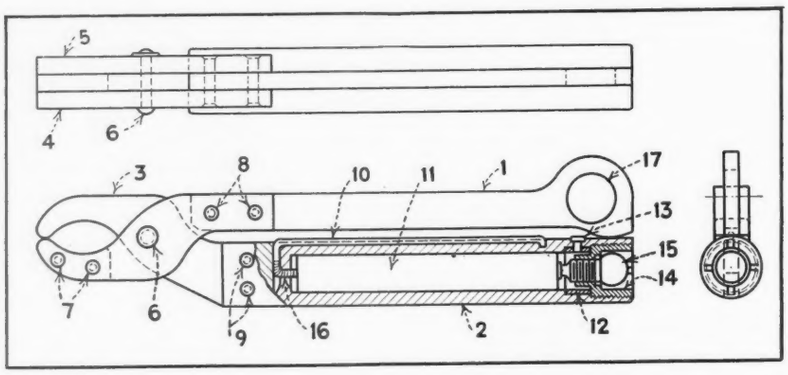
In the handle of this puller there is a means of quickly testing fuses. It consists of a pencil type of flashlight battery which is inserted into a hole drilled in the handle. On its lower end the battery makes contact with spring *16* which is rigidly attached to the adjustable linking wire, *10*. This wire fits into a groove in the handle and is held in place by cement.

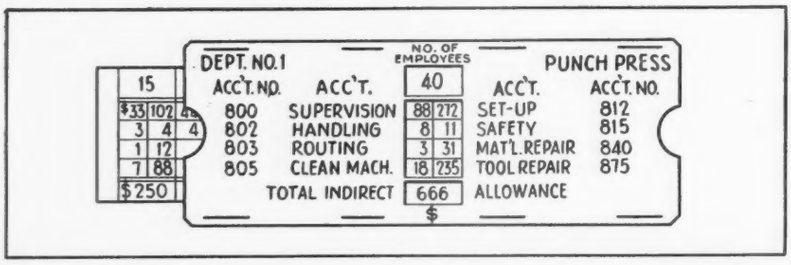
The brass ring, *12*, is pressed in place in the front end of the handle. It carries a contact button, *13*. In contact with ring *12* is a threaded brass ring, *14*, which forms the housing for the flashlight bulb, *15*. The slotted end permits this housing to be screwed directly into the fiber handle.

Normally the circuit of the lamp is broken by the gap between button *13* and wire *10*. However, if a fuse or any metal object is placed across the gap, the circuit is closed and the lamp will light. Wire *10* is made long enough for fuses of various lengths.

If it is desired to use the flashlight for lighting the way in dark places, a ring wide enough to make contact with both wire *10* and button *13* can be made to slide along the handle.

(Continued on page 100)



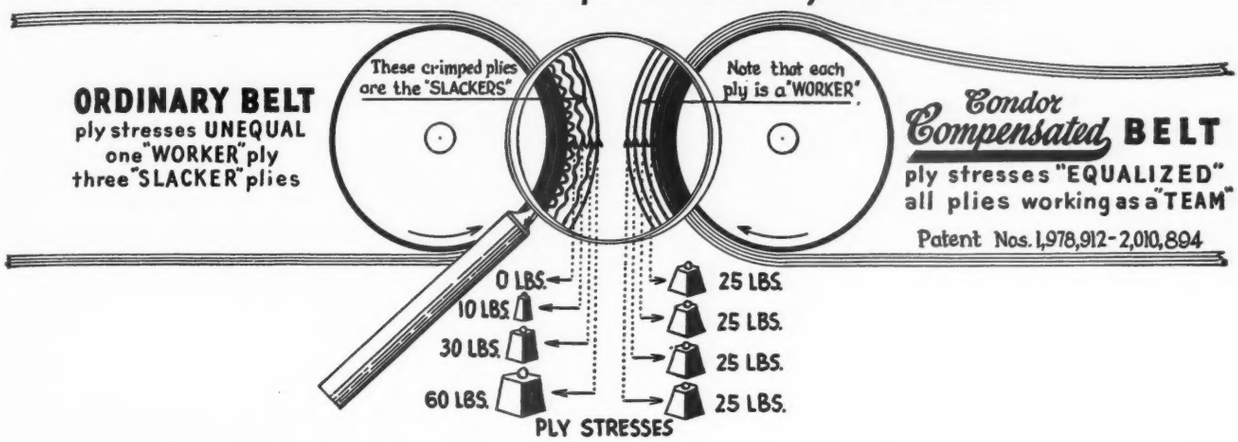


WHY Condor Compensated ?

PATENTED

TRADE MARK REGISTERED

The Belt With Equalized Ply Stresses

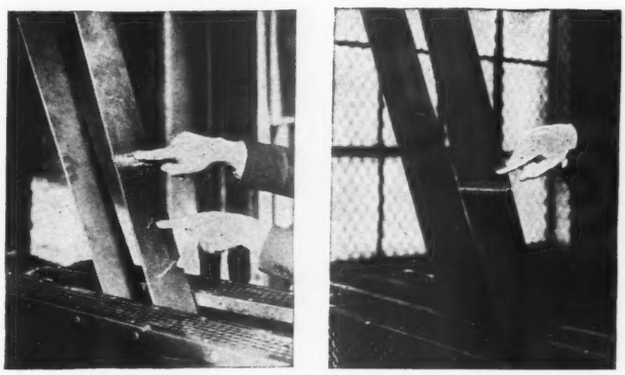


COMPARE the principle of construction of Condor Compensated Belt with that of ordinary rubber belt in the diagram above. Note that when Condor Compensated is flexed around the pulley—where the destructive work is done—all plies work together as a team, each bearing an equal share of the load. Whereas, in ordinary rubber belt, the outside ply carries the greater load—the "back-breaking" load, as indicated by the weights, that ruptures or separates the outer plies and breaks the fasteners—and the inside plies buckle and crimp to shirk their load, to increase creep and wear—resulting in premature breakdown.

This exclusive patented Manhattan construction—in which plies are compensated for the unequal stresses and strains developed at the arc of contact—and the special pulley side surface which permits low tension operation have accounted for 12 distinct advantages* on thousands of industrial drives. You, too, will get greater operating efficiency and economy by putting Condor Compensated, the low tension rubber belt, on your drives. Available also in Type F where rubber friction pulley surface is desired, and in Type B where some slip is necessary.

*12 ADVANTAGES

1. Ruptures in outside ply eliminated
2. Freedom from ply separation
3. Longer fastener life
4. Can be operated on smaller pulleys
5. Less bearing, shafting and hanger troubles
6. For heavy loads, plies may be increased with same pulleys
7. Operation less affected by atmospheric conditions
8. Higher overload capacity or margin of safety
9. Less wear on pulley side
10. Can be dressed without injury to belt
11. High production efficiency
12. Material reduction in belting costs



Unretouched photographs of ordinary rubber belt and Condor Compensated Belt after operating an equal number of hours on the same type drive. Notice belt at right has no "broken back" and shows no fastener wear—it's Condor Compensated.

Condor PRODUCTS

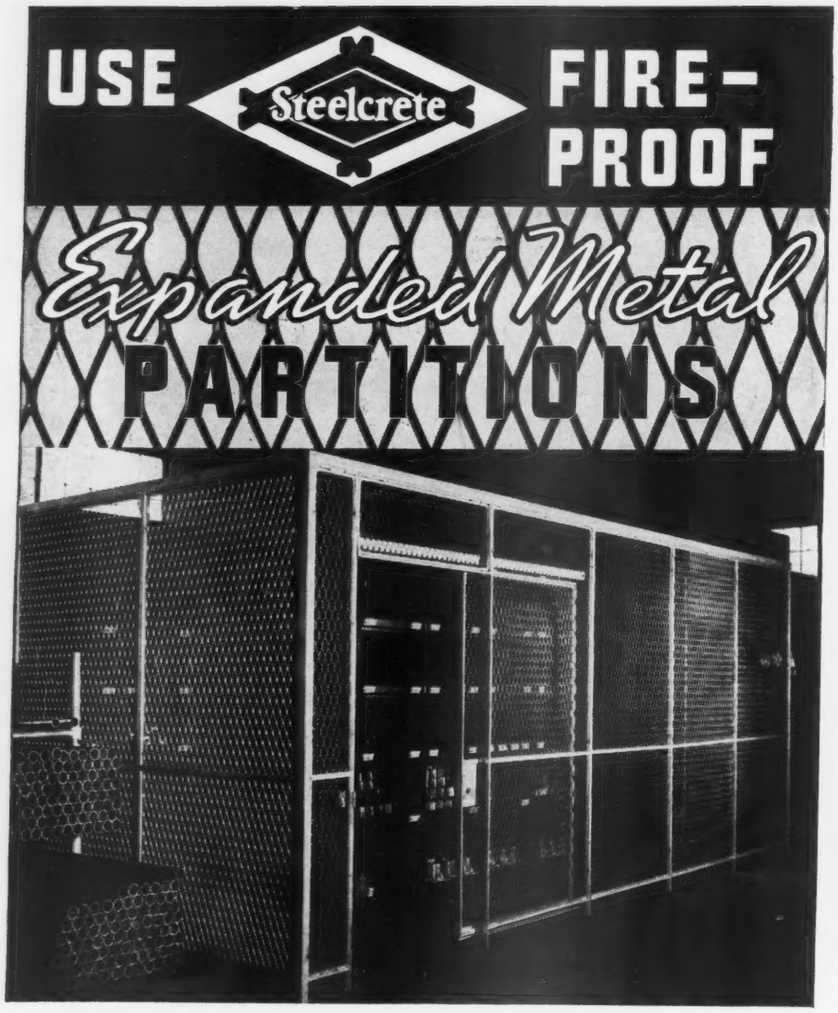
Conveyor Belt	Air and Steam Hose	Suction Hose	Industrial Brake Lining	Rubber Covered Rolls
Transmission Belt	Fire and Water Hose	Textile Specialties	Molded Rubber Goods	
V-Belt	Oil and Gasoline Hose	Chute Lining	Rubber Lined Tanks	Abrasive Wheels

MANHATTAN

THE MANHATTAN RUBBER MFG. DIVISION

OF RAYBESTOS-MANHATTAN, INC.

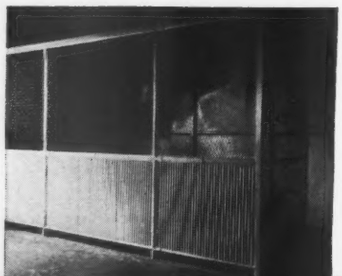
EXECUTIVE OFFICES AND FACTORIES, 33 TOWNSEND ST., PASSAIC, N. J.



They Conserve Light and Permit Free Circulation of Air

Open mesh partitions of Steelcrete Expanded Metal can be quickly erected and are adaptable to any enclosure requirement. Unlike solid partitions they do not obstruct the circulation of air. This advantage effects a saving of heat in winter months. The open mesh also lets the light through.

The Steelcrete factory and nearby Steelcrete shops can supply Expanded Metal Partitions custom-made to your requirements. Standard units and accessories are also available. Write the nearest office for complete details and a copy of the Steelcrete Handbook outlining many uses for Expanded Metal.



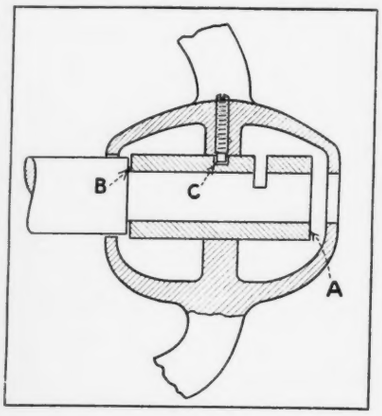
THE CONSOLIDATED EXPANDED METAL COMPANIES
WHEELING, WEST VIRGINIA
Branch Offices and Warehouses:
New York • Chicago • Cincinnati • Cleveland • Pittsburgh • Philadelphia • Boston • Buffalo • Houston • Atlanta
Export Office: 330 West 42nd St., New York, N. Y.

Use Hammer First, to Remove Bearing Screw

J. H. SAUVE, *Temiscaming, Que., Canada*

It is often a very difficult matter to remove the screws used on some motors to hold the bearing shells in place. Many a harsh word has been said while trying to get one of these screws out.

When faced with this problem a



very simple solution is to knock the bearing in the direction which arrow *A* indicates. The reason for doing this is that the shaft pounding on the bearing at *B*, through the endplay, pushes the bearing tightly against the screw at *C*. Therefore, a tap with the hammer at *A* will loosen the screw.

It may sound foolish, but try it next time.

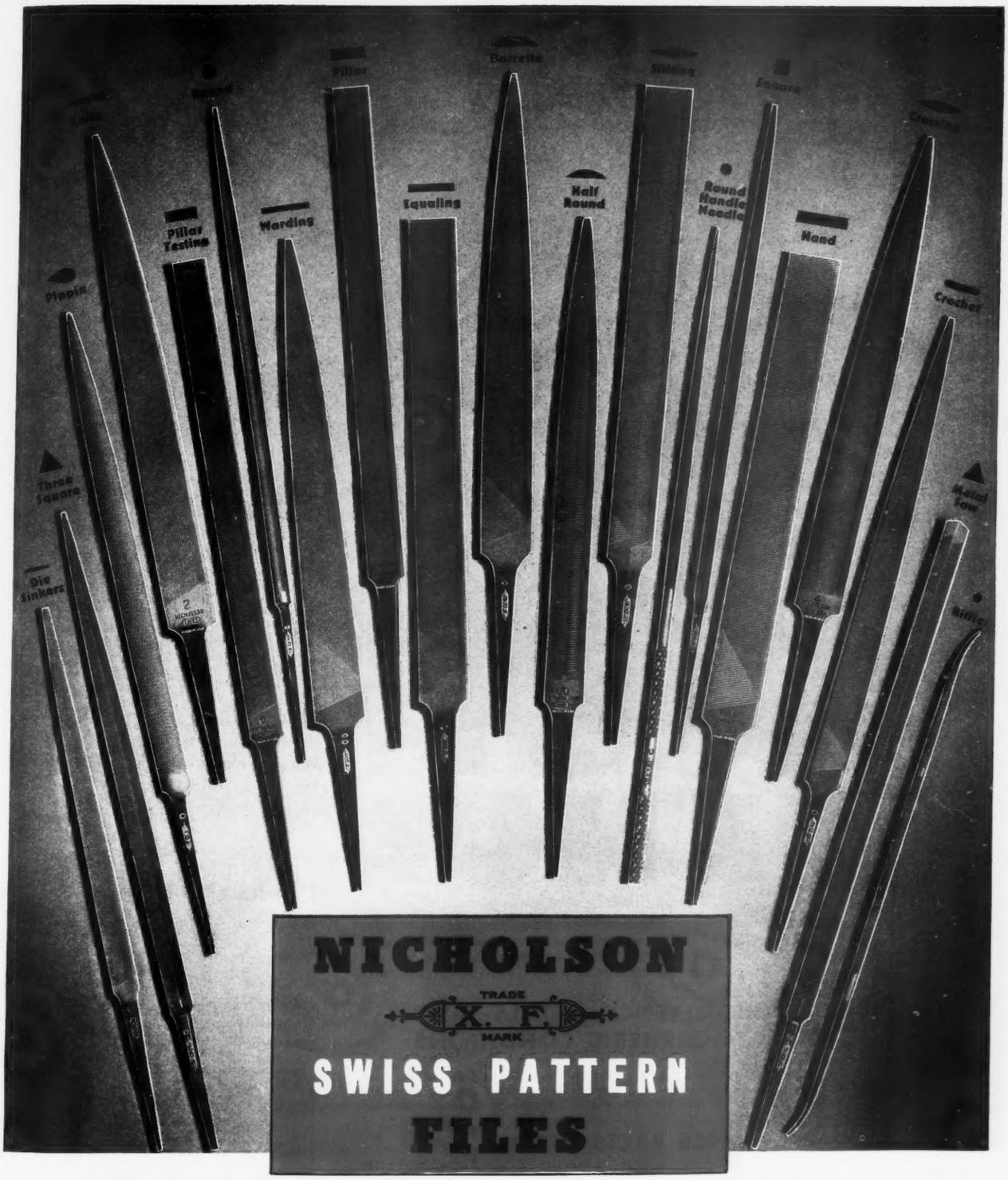
•

Precautions That Help to Keep Shafts Aligned

S. H. COLEMAN, *Roanoke, Va.*

Improperly aligned shafts and couplings of direct-connected machinery are responsible for many common troubles, such as increased wear or destruction of bearings, damage to flexible couplings, vibration of machines. In many cases where these troubles occur the shafts have presumably been checked for alignment, and subsequent misalignment has been caused by factors not considered at that time.

A frequent cause is the forced movement of machine bases in relation to each other. With separate foundations this may be due to settling. If both machines are mounted on a single bedplate the hold-down bolts may become loosened, or the bases and plates may be distorted by some outside force. A typical example is the effect of expansion or erection strains in the piping of a direct-connected pump. In most instances such effects can be minimized by



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For tool and die making . . . for all similar work where superior workmanship and extra fine files are needed . . . Nicholson X.F. Swiss Pattern Files are made in a wide variety of shapes and sizes and up to seven numbers of cut.

These precision files are produced in a large department of the Nicholson File Company especially equipped for the purpose.

X.F. Swiss Pattern Files are made from selected file steel, with all the care that is typical of Nicholson production methods. You can always depend on their uniformly high quality and their ability to do your precision filing with the maximum efficiency.

Warding, Equaling and Joint Files, supplied in regular thicknesses, may also be obtained in minimum quantities of 1 dozen, without extra charge, in many B. & S. Gauges. Nicholson File Company, Providence, R. I., U. S. A.

A FILE FOR EVERY PURPOSE

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means longer fence life—at no extra cost

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postponing permanent adjustment until all mechanical work has been finished on both machines, in order that operating conditions can be duplicated as closely as possible. Shafts can then be lined up and dowels used to secure machine bases against further movement.

In any case, however, alignment should be checked at frequent intervals to make sure that nothing has happened during operation and maintenance of the machines to upset the original conditions.

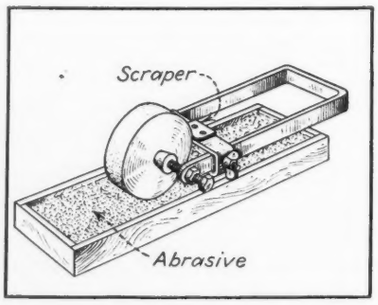
Another frequent source of alignment trouble is failure to allow for the vertical expansion of machines that are heated when running. For example, a hot water pump must be set slightly lower than its driving motor, when installed, so that after it is in service the two shafts will have the same elevation. It is advisable to approximate this condition, run the unit until thoroughly heated, shut it down, and then immediately check the alignment while the temperatures are very nearly those obtained during regular operation.

Guards removed from machines to speed up operations are, first of all, a safety problem that must be speedily dealt with. They're also a sign that a check-up is needed to see if a more effective layout of the workplace is possible.

Polishing Wheel Holder Applies Abrasives Evenly

CHAS. H. WILLEY, *Penacook, N. H.*

A method that was recently worked out for applying various grades of abrasives to polishing wheels has been found to be a consisderable improvement over the older, cruder scheme of putting the wheel on a stick and running it through the "emery" box.



It will be seen from the illustration that the fixture is easy to make. We used 3/16x1-in. steel bar, a suitable

Out of 18 Months of Research and Development Has Come

AN ENTIRELY NEW LIGHTING UNIT

NAME OF MANUFACTURER
500 WATTS
COMPLIANCE WITH SPECIFICATIONS UNDER APPROVED INSPECTION PROCEDURE OF RLM STANDARDS INSTITUTE CERTIFIED BY ELECTRICAL TESTING LABORATORIES
RLM

The New RLM SILVERED BOWL DIFFUSER

The new RLM Silvered Bowl Diffuser marks another forward step in the science of Industrial Light Conditioning. Jointly developed by the Mazda Lamp Manufacturers and the members of the RLM STANDARDS INSTITUTE, this new unit is the *first to fully utilize the distinctive indirect lighting properties* of the Silvered Bowl Mazda Lamp and yet retain a high degree of light utilization.

In the RLM Silvered Bowl Diffuser, the only light source visible in the normal field of view is the low brightness portion of the porcelain enamel reflecting surface. The direct light from the lamp itself is shielded from view by its silvered bowl. Thus installations of these units produce a light which is particularly pleasing and comfortable to the eye.

RLM Silvered Bowl Diffusers, attested to by the Electrical Testing Laboratories as conforming to RLM specifications, can be readily identified by the RLM Label. Further information may be secured from your electrical wholesaler or any member of the Institute. Names of members as well as copies of the RLM specifications for RLM SILVERED BOWL DIFFUSERS, RLM DOME, RLM DEEP BOWL and RLM SYMMETRICAL ANGLE REFLECTORS may be had by addressing the Institute.

The letters RLM stand for Reflector and Lighting Equipment Manufacturers

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INCORPORATED

20 N. WACKER DRIVE · SUITE 1130 · CHICAGO, ILL.

THE CERTIFICATE OF RLM UNIFORM QUALITY

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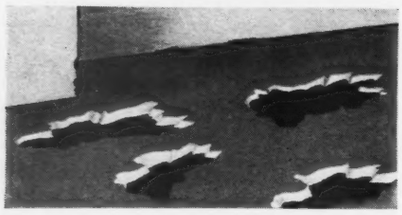
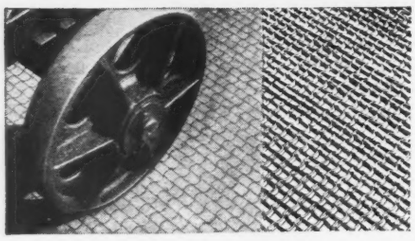


The Possibility of Ruts, Holes, Deterioration is Eliminated by

ACME FLOORSTEEL



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Your floors can be protected economically from the damaging effects of rolling loads. Acme Heavy-Duty Floorsteel is furnished in long-length rolls which reduce installation costs to a minimum. It is formed in mesh $1\frac{1}{4}$" x $1\frac{1}{4}$" - $\frac{5}{8}$" deep, and imbedded, flush with the surface, in concrete, asphalt or other suitable material.

A lasting, smooth, quiet and non-skid surface is obtained. Several sections of the strong small mesh support every truck wheel, thus preventing ruts or disintegration. Acme Floorsteel actually becomes stronger with use.

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length of this material being formed into a U-shape. On it is fastened a crossbar that carries an adjustable scraper blade to remove surplus abrasive and give a smooth, true-faced wheel. Different-shaped scrapers are, of course, used to match the contour of the wheels.

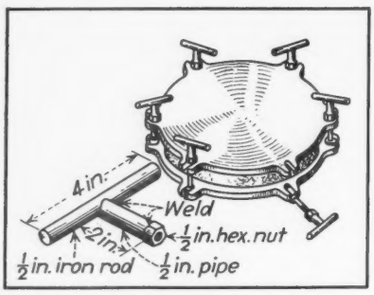
The cone-hub bearings are adjustable in order to center the wheel so that it will run true.

•

Modified Wingnut More Convenient to Handle

CARL O. LANDRUM, *Dumont, N. J.*

When a sectional liquid filter required replacement of four out of six wingnuts it was decided to make up something more substantial and easier



to handle. The sketch shows the construction of the nut or clamping device that was adopted. It has been found to be so handy and satisfactory all around that they are being used on the covers of large strainers and mixers.

As will be seen, the hexagon nut is welded to a piece of pipe long enough to accommodate the length of bolt passing through it. On the other end, the pipe is slightly recessed to fit the handle and make a neater weld.

•

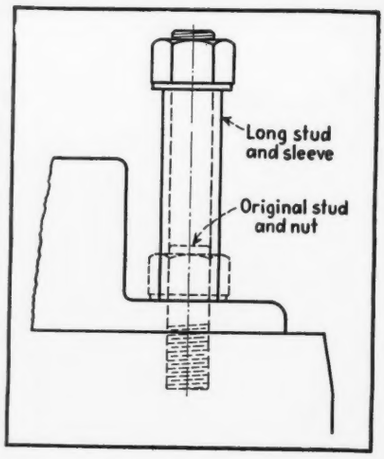
Long Studs Better Than Short for Grinding Mill

C. A. LEE, *Evanston, Ill.*

Several of our grinding mills are occasionally required to handle a certain material having such a combination of hardness and particle size that excessive vibration is created.

The housing of these mills was formerly held down to the bull ring by short studs, which frequently snapped off under the stress put on them. To remedy this annoying condition we made the studs about 1 ft. long and put sleeves over them, as shown in the sketch.

Since making this change there has been practically no more trouble. I presume the explanation is that



there is now a greater length of metal exposed to the same strain (using this word in the engineering sense of deformation in response to stress) and therefore reduced unit strain.

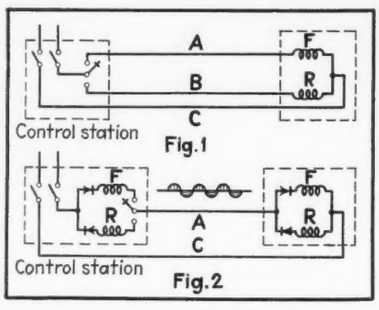
Electric insect traps have done in many a bug of late. Attracted by a light source in dark locations or during night hours, the pests are electrocuted on exposed wires surrounding the light.

Rectifiers Reduce Number of Motor Control Wires

R. F. EMERSON, *Industrial Department General Electric Co., Schenectady, N. Y.*

Occasionally it is desirable to reduce to a minimum the number of wires which go from an operator's control station to a control panel located near the motor. This situation arose in connection with the spinning of the suspension cables for the San Francisco-Oakland bridge.

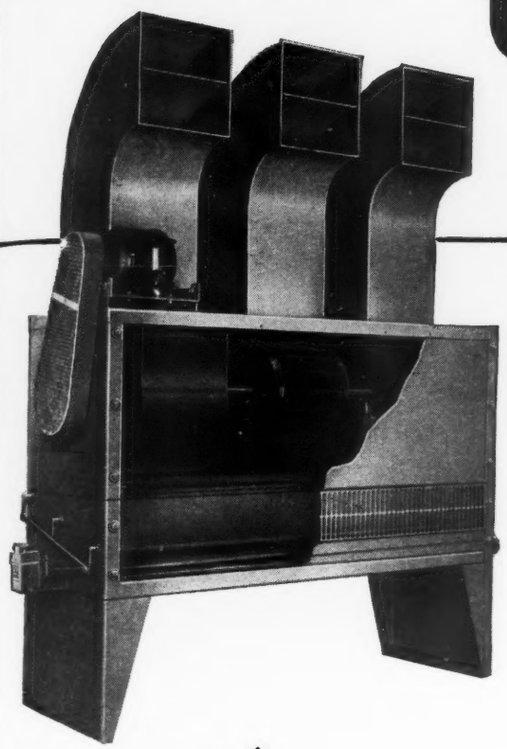
On this bridge there are two spans, each more than a mile long. It was necessary to apply power at both ends of a span simultaneously so that two 75-hp. induction motors, one located at each end of the span, would start, run, and stop together. These



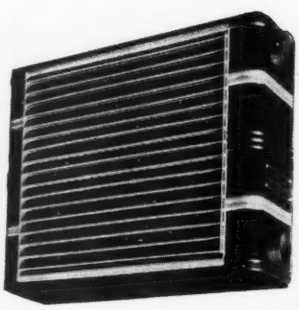
HEAT

75% to 80% *Quicker*
20% to 30% *Less Fuel*
30% to 40% *Lower Investment*

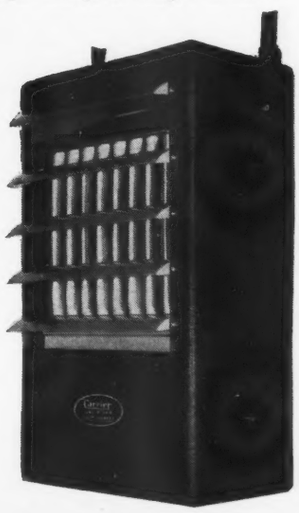
Carrier Unit Heating



CARRIER HEAT DIFFUSERS. Here's the last word in efficient, economical heating—the Carrier Heat Diffuser. Available in floor mounted, suspended and inverted models, every size offers these exclusive Carrier features: (1) Non-ferrous coils, with famous Carrier return bend principle that eliminates strain from expansion and contraction, makes leaking virtually impossible. (2) New, greatly-reduced motor speeds and precision-made, balanced fan assemblies that reduce noise and make vibration negligible. (3) Thermajust control—maintains constant temperature by varying heat output of diffuser to balance heat losses.



CARRIER UNIT HEATERS. Have the same exclusive features as the Carrier Heat Diffuser, and are ideal for heating or ventilating smaller spaces. Adjustable louvres direct heat exactly where desired. Distinctively-styled to harmonize with even the finest office furnishings. Complete ranges of sizes.



NEW—THE CARRIER GAS-FIRED UNIT HEATER! No need for steam or hot water supply with this newest Carrier Unit Heater! Connecting directly to your gas supply, it provides from 1300 to 3900 cubic feet of warm air per minute—depending on size of unit selected. Enables new savings in (1) first cost, (2) installation cost, (3) installation time, (4) space, (5) piping materials and time. Approved by A.G.A.

Quiet, Low-Speed Equipment Now Available For Structures of Every Size and Type

• This year Carrier offers a larger line of Unit Heating equipment than ever before. New sizes — to insure most efficient results. New *designs* — such as vertical suspended units and gas-fired units, to answer specific needs. New *construction* features such as "corrosion resisting" units — for use where moisture is present. And throughout the line, motor speeds have been reduced to insure even greater economy and more quiet operation.

Ask your local Carrier dealer to tell you more about the Carrier Unit Heaters — how they can reduce your fuel bills 20% to 30% — reduce your heating investment substantially and assure maximum working comfort. Or, if you prefer, mail coupon for latest descriptive booklets. No obligation!

CARRIER CORPORATION, Syracuse, N. Y., Desk 908

Without obligation, send me latest technical booklets on ☐ Carrier Heat Diffusers; ☐ Carrier Unit Heaters; ☐ Carrier Gas-Fired Unit Heaters.

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Company.....

Address.....

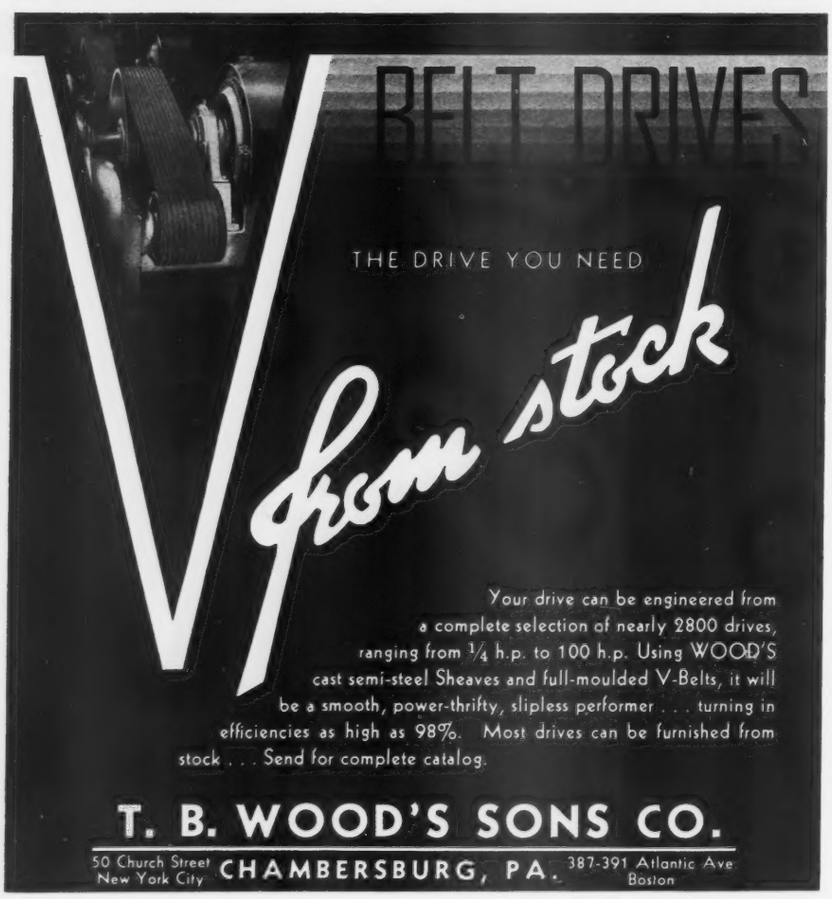
City.....

● Virtually every major public utility and auto manufacturer uses LUX Fixed Systems—self-acting fire protection.

A heat-actuated control releases Lux snow-and-gas—clean, dry, harmless. Kills fires in a few seconds. For vats, dip-tanks, generators, transformers, etc.

Write today for "Lux Makes The Difference."

Walter Kidde & Company
32 West Street Bloomfield, N. J.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THE DRIVE YOU NEED
V from stock
Your drive can be engineered from a complete selection of nearly 2800 drives, ranging from 1/4 h.p. to 100 h.p. Using WOOD'S cast semi-steel Sheaves and full-moulded V-Belts, it will be a smooth, power-thrifty, slipless performer . . . turning in efficiencies as high as 98%. Most drives can be furnished from stock . . . Send for complete catalog.
T. B. WOOD'S SONS CO.
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motors were used to drive the spinning wheels or "jennies" which travel back and forth across the span, carrying loops of suspension wire. Furthermore, these two widely separated motors had to be under the control of a single operator located at one end of the span.

To reduce the number of control wires across the span half-wave rectifiers were used. Ordinarily, at least three control wires are required for reversing a motor, as shown in Figure 1. Line *A* is used for energizing the forward contactor *F*, and *B* for energizing the reverse contactor *R*. In Figure 2 line *B* has been eliminated and line *A* carries a rectified current from two half-wave copper oxide rectifiers connected in opposition. On one throw of the single-pole, double-throw switch half-waves, shown by vertical shading in Figure 2, operate one reversing coil. On the other throw of the switch, these half-waves are blocked out and the horizontally shaded half-waves operate the other reversing coil.

These diagrams indicate a saving of one out of three wires. However, with any other drives having a common return wire, *C*, only one additional wire would be needed for each additional reversing drive.

There are many drives in industry where it is desirable to reduce the number of control wires, particularly where trolley wires are involved. Copper oxide rectifiers may be applicable in many such cases.

•

In Emergency Blower Keeps Oil Circuit Breaker Cool

H. C. Sleman, *New York*

When oil circuit breaker temperatures exceed design limits prompt action is necessary to avoid heating to the point where there is danger of fire, or destruction of the breaker. If overheating results from excessive loads the obvious remedy is to reduce the current at the breaker terminals. If poor contact is responsible, the breaker must be removed from service and the trouble rectified.

Where the breakers are installed on important feeders or drives it often happens that neither of these remedies can be applied immediately without interfering with production. In such instances it may be possible to use a portable, motor-driven blower to cool the breaker until the cause of the heating can be remedied.

The blast of air from the blower serves two purposes: (1) to speed up the rate of heat dissipation from the exposed metal surfaces; (2) to blow away vapor given off by the

Photographs courtesy of
Wells Mfg. Corp.,
Three Rivers, Michigan.

Men and Machines...

more productive with

FLEXIBLE-BACK DISSTON BANDS

Three different styles of set in Disston Hard-Edge Metal Band Saws. 6, 8, 10, 12, 14, 18 and 22 teeth to inch.

"S" straight tooth — "R" raker tooth — "G" group set

Disston Metal Band Saws are made (1) with blades hardened throughout; operate at high peripheral speed; furnished with any tooth spacing desired or (2) with blades hardened on tooth edge only: "Hard-Edge, Flexible-Back Band Saws." Teeth are not punched—they are milled, and then accurately set by machine.

Costs are cut, earnings increased, when you cut with Disston Bands. They stay sharp, cut accurately on the widest range of materials, sizes and shapes ever cut on band-saw machines.

Every tooth is hardened alike; edge hardened to base of teeth. Teeth *milled* . . . scientifically and accurately set.

You need Disston Hard-Edge, Flexible-Back Bands. Unrivalled in taking the bend over a wheel. Unequalled in resisting the strain of quarter turning.

No Substitute for Disston Steel

In metal-cutting saws! Gives *modern* results you must have in cutting new alloys, new hard materials, under new and harder conditions. Tough, flexible, durable. Developed in Disston Steel Works.

For complete data, write Henry Disston & Sons, Inc., 924 Tacony, Philadelphia, U. S. A. *Branches:* Boston, Chicago, Detroit, Memphis, New Orleans, Seattle, Portland, Ore., San Francisco, Vancouver, B. C. *Canadian Factory:* Toronto.

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DISSTON METAL-CUTTING BAND SAWS

DeVilbiss showed us how to cut our finishing costs!

Wherever keen business men discuss paint-spraying, the economy of DeVilbiss Equipment is sure to be mentioned. *That's* not a happenstance. It's the result of years of concentrated effort on the part of DeVilbiss to build paint-spraying equipment of the highest efficiency.

To achieve this objective, DeVilbiss long ago established these policies:

¶ To acquire thorough knowledge of the needs of every industry using paint-spraying equipment. ¶ To manufacture a complete line to meet all ordinary paint-spraying requirements. ¶ To employ an engineering staff of the highest caliber to create equipment for new uses. ¶ To operate a highly trained organization in the field for the purpose of making sure that DeVilbiss Equipment operates efficiently everywhere. These experts are also employed for assignment to *any* job that presents an unusual problem in paint-spraying. ¶ To build products skilfully. To use the highest quality of materials. To manufacture with the most modern facilities available.

If you have a product-finishing problem, get in touch with headquarters. Write, wire, or 'phone. A DeVilbiss expert will be sent promptly. No obligation. The DeVilbiss Company, Toledo, Ohio.

The most advanced type of spray-painting and finishing equipment, exhaust systems, air compressors, hose and hose connections.

DE VILBISS SPRAY SYSTEMS

1888 · FIFTY YEARS OF QUALITY PRODUCTS · 1938

hot oil, which might become ignited by sparks from other equipment.

As a check on the effectiveness of this method of cooling, a thermometer should always be fastened on the side of the oil tank. Ordinary, etched-stem glass thermometers are suitable for this purpose.

To secure a true indication of the temperature inside the tank, the paint should be scraped away from the metal in contact with the marked immersion section of the bulb and stem of the thermometer. After it is in place this sensitive section should be embedded in closely packed tinfoil and then covered with asbestos or some other type of heat-insulating material.

When fastening the thermometer to the tank, avoid covering too much of the radiating surface. Use string or heavy thread, instead of tape, to hold the stem and bulb covering against the metal.

•

Rubber Matting Prevents Slipping Around Machinery

R. MURPHY, *Lakewood, Ohio*

Accidents caused by slipping on smooth floors in our crating and shipping departments have been reduced by placing rubber mats in front of all saws, shapers, planers and other woodworking equipment, and welders.

Ribbed rubber matting is used, and has been found to wear for a long time. It is tacked to the floor and the edges are protected and held down with brass binding which is tacked in place.

•

Applying D.C. to A.C. Motor Produces Dynamic Braking

SOURCE, *Westinghouse Electric & Manufacturing Company, East Pittsburgh*

Dynamic braking of a squirrel-cage motor by disconnecting the a.c. power and applying direct current to one phase of the stator is not new, but so far it has not been widely used, although the scheme possesses several advantages.

The diagram shows a complete control for d.c. braking, including a copper oxide rectifier to furnish the direct current.

When the Start button is depressed, the circuit is completed to the No. 1 line contactor and the motor starts. An interlock contact of this contactor makes a circuit between the Start pushbutton and No. 3 relay coil, thereby energizing No. 3 relay and completing the holding circuit for both No. 1 and No. 3. The normally

"Come in . . . we're ready to talk Quality!"

GULF ENGINEERS *help plant men reduce maintenance costs with* GULF'S HIGHER QUALITY *oils and greases*

THERE ARE THREE IMPORTANT REASONS why plant executives are saying, "Come in—we're ready to talk quality," to Gulf representatives:

FIRST, plant men today are placing greater demands on their machinery. The annoyance and expense of shutdowns for repairs or adjustments and resultant production losses must be avoided.

SECOND, they are placing maintenance costs under closer scrutiny and are demanding reductions in operating expenses.

THIRD, they have found that their machines operate more efficiently when protected with Gulf's higher quality lubricants, applied as recommended by an experienced Gulf lubrication engineer.

When you use Gulf's higher quality lubricants, you are getting the benefit of many years of research and experience with lubrication problems by Gulf's large staff of technical men. They have perfected oils and greases which can withstand far greater punishment than today's machines will give them. Thus you are assured of lubricants which possess a margin of safety well beyond average requirements. The machines to which these quality lubricants are applied nearly always make better production records.

The next time a Gulf engineer calls at your plant ask him to look over your equipment and recommend improved lubrication practice. You will not be obligated in any way, so why not take advantage of this money-saving service at once?

Gulf Oil Corporation—Gulf Refining Company
Division Sales Offices: Boston, New York, Philadelphia, Pittsburgh, Atlanta, New Orleans, Houston, Louisville, Toledo.

GULF INDUSTRIAL LUBRICATION

THIS
LESS-NOISE BOOTH
STOPS
PHONE MISTAKES

● Machinery noise constantly interferes with factory phone service. The only solution is a booth which insures less noise at the telephone itself. This is why hundreds of plants use the Burgess Acousti-booth. Constructed with a noise absorbing acoustical lining, it blots up machinery roar and creates an island of quiet around the phone.

Pays Dividends

● Use of a Burgess phone booth pays dividends. Phone service is made more useful. Orders are easier to hear or transmit. Misunderstandings and costly mistakes are eliminated.

MODEL 301—Patented Burgess acoustic lining inside this booth blots up noise. Factory roar does not interfere with the phone. You hear clearly and avoid time-wasting, expense-making mistakes in verbal orders.

Pictured to the left is one of three Burgess booth models designed specifically for shop use. Other models are full length and bench types. Made entirely of steel.

Get Complete Story

● Now send the coupon for illustrated Bulletin 128 giving description, specifications, prices, and terms on all 3 models of Burgess telephone Acousti-booths. Learn how they save you money by improving shop phone service.

SEND: Burgess Acousti-Booth Bulletin 128

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Burgess Battery Co., Dept. F, 500 W. Huron, Chicago

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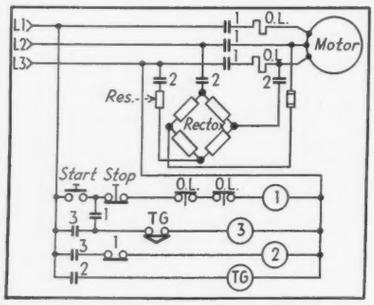
BURGESS

closed interlock of No. 1 contactor opens the circuit of No. 2 relay; hence there is no further functioning of the control while the motor is running. Contactors Nos. 1 and 2 are mechanically interlocked.

If the Stop button is depressed the holding circuit to No. 1 line contactor is broken and a.c. power is disconnected from the motor. However, the



holding circuit to No. 3 relay is maintained by its own contact and as soon as the No. 1 normally closed interlock makes the contact to No. 2 contactor, direct current is applied to one phase of the motor, causing it to decelerate. Another contact of No. 2 energizes the coil of time-delay relay *TG*, which is adjusted to provide a delay slightly longer than the time required to bring the motor to a stop. When relay *TG* opens its contacts, relays Nos. 2 and 3, as well as *TG*, are all de-energized and the d.c. power is disconnected from the motor.

A resistor is placed in the a.c. side of the Rectox rectifier to reduce the voltage applied to it, since the d.c. voltage across the motor need not be more than about 25 per cent of the normal a.c. volts.

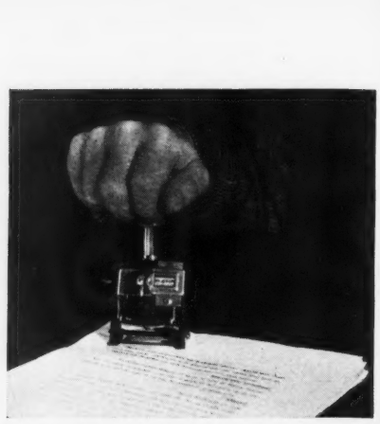
In taping, an ordinary clothes pin of the spring type is a handy device for holding the first layer of tape while applying the second.

Two Jobs Become One

JOHN F. PIERCE
Director, Office Service Department
Tennessee Valley Authority

Every piece of correspondence in the Central Files of the Authority has to be date stamped and counted. Two operations used to be involved—stamping and counting. Each piece of paper was thus handled twice.

This made it hard to do the job at high speed. Also, it was difficult



to maintain accuracy because the operator was frequently interrupted.

But the problem vanished when it occurred to us to design an instrument—a cyclometer attached to a date stamp—which does the dating and counting in a single operation.

Scrap cast iron too large to be sold as scrap cluttered one company's yard for years. Cut up into charge-box size with oxy-acetylene blowpipes, it brought a price considerably above the cost of cutting.

No Motor Trouble with This Inspection Schedule

K. B. HUMPHREY, *Sayreville, N. J.*

A large manufacturing plant that operates several synchronous motors rated 100 to 300 hp., three-phase, 2,400 volts, has found the following inspection schedule to give good results:

1. Daily inspections are made, usually in the morning about an hour after the motor is started for the day's run. Any heating of the bearings or frame is noted, and oil levels are checked. Bearing caps are lifted to see that the oil rings are turning. The commutator on the exciter is wiped off with a clean rag. Power factor is checked. The watt-hour meter is read to determine the previous day's consumption. Any unusual conditions in load are noted.

2. Monthly tests of insulation resistance are made and the results recorded.

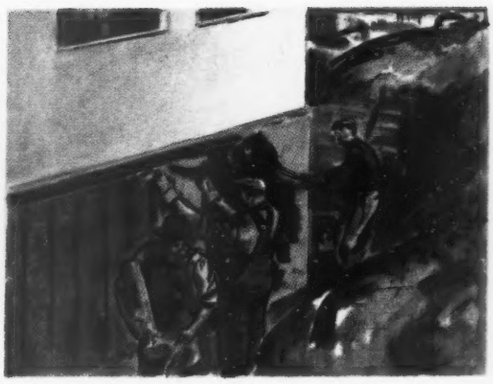
3. Every three months, oftener if the service is severe, the oil switch tanks are dropped, contacts, bushings, and other parts are examined, and general operation is checked. The condition of the insulating oil is also noted. Commutator and sliprings are dressed with a commutator stone if necessary. Brushes are also checked

This time we'll WATERPROOF the building

1 **TOM WAS** hardly more than a youngster when his father's death threw the business into his lap. He wanted to make a go of it and, naturally enough, tried to cut cost corners wherever he could.

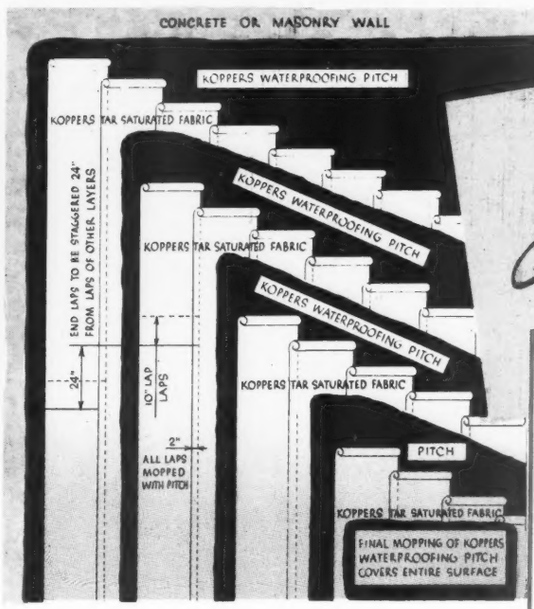
2. **BOOMING** business made it necessary to build an addition to the warehouse. Wiser heads advised waterproofed foundation, but Tom vetoed the idea to save a few dollars.

3. **SEVERAL YEARS** later small breaks developed unnoticed in the concrete. Water seeped through and caused considerable damage to goods stored in the basement.



4. **EXCAVATIONS** had to be made around the warehouse, concrete had to be repaired and waterproofing applied. Of course it was the only course then . . . but it was costly.

5. **TOM IS** more mature now. Business has been good and he's planning a new, larger building. This time he specifies Koppers Membrane Waterproofing.


CONCRETE OR MASONRY WALL
KOPPERS WATERPROOFING PITCH
KOPPERS TAR SATURATED FABRIC
KOPPERS WATERPROOFING PITCH
KOPPERS TAR SATURATED FABRIC
KOPPERS WATERPROOFING PITCH
KOPPERS TAR SATURATED FABRIC
PITCH
KOPPERS TAR SATURATED FABRIC
FINAL MOPPING OF KOPPERS WATERPROOFING PITCH COVERS ENTIRE SURFACE
END LAPS TO BE STAGGERED 24" FROM LAPS OF OTHER LAYERS
24"
10" LAP LAPS
2" ALL LAPS MOPPED WITH PITCH

6. **LAYER UPON** layer of Koppers Tarred Fabric and Waterproofing Pitch forms a water-tight blanket for the foundation. No more seepage.

KOPPERS Waterproofing

Cost of applying Koppers Membrane Waterproofing to new buildings is small compared to the potential loss which underground moisture can cause. Koppers Waterproofing proves its worth under severe conditions . . . prevents deterioration of concrete or masonry. If you have some question in mind about a general condition or some particular job, drop Koppers a line. Our representative in your territory will bring you the results of extensive research by Koppers engineers.

KOPPERS COMPANY, Tar and Chemical Division, Pittsburgh, Pa.

KOPPERS PRODUCTS

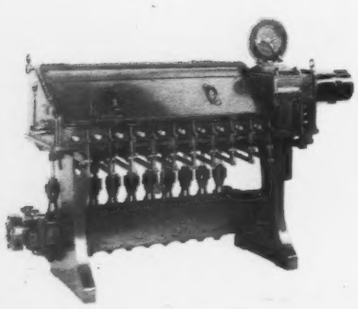
Koppers Roofing . . . Waterproofing . . . Dampproofing . . . Bituminous-base Paints . . . American Hammered Piston Rings . . . Fast's Self-aligning Couplings . . . Platework . . . Tanks . . . Cast Iron and Steel Pipe . . . Gas, Air, Water, Tar Valves . . . D-H-S Bronze Castings . . . Iron Castings . . . Western Fire Hydrants . . . Locomotive Packing . . . Creosote Oil . . . Treated Timber, Lumber and Piling . . . Materials-Handling Equipment . . . Tarmac Paving Materials . . . Coal . . . Coke . . . Gas . . . Disinfectants . . . Insecticides . . . Deodorants . . . Pipe . . . Weed Killers . . . Tar Acids . . . Light Oils . . . Naphthalene

a KOPPERS product

USE BITUMINOUS COAL

The mining, transportation and distribution of coal is a major labor-employing industry directly affecting millions.

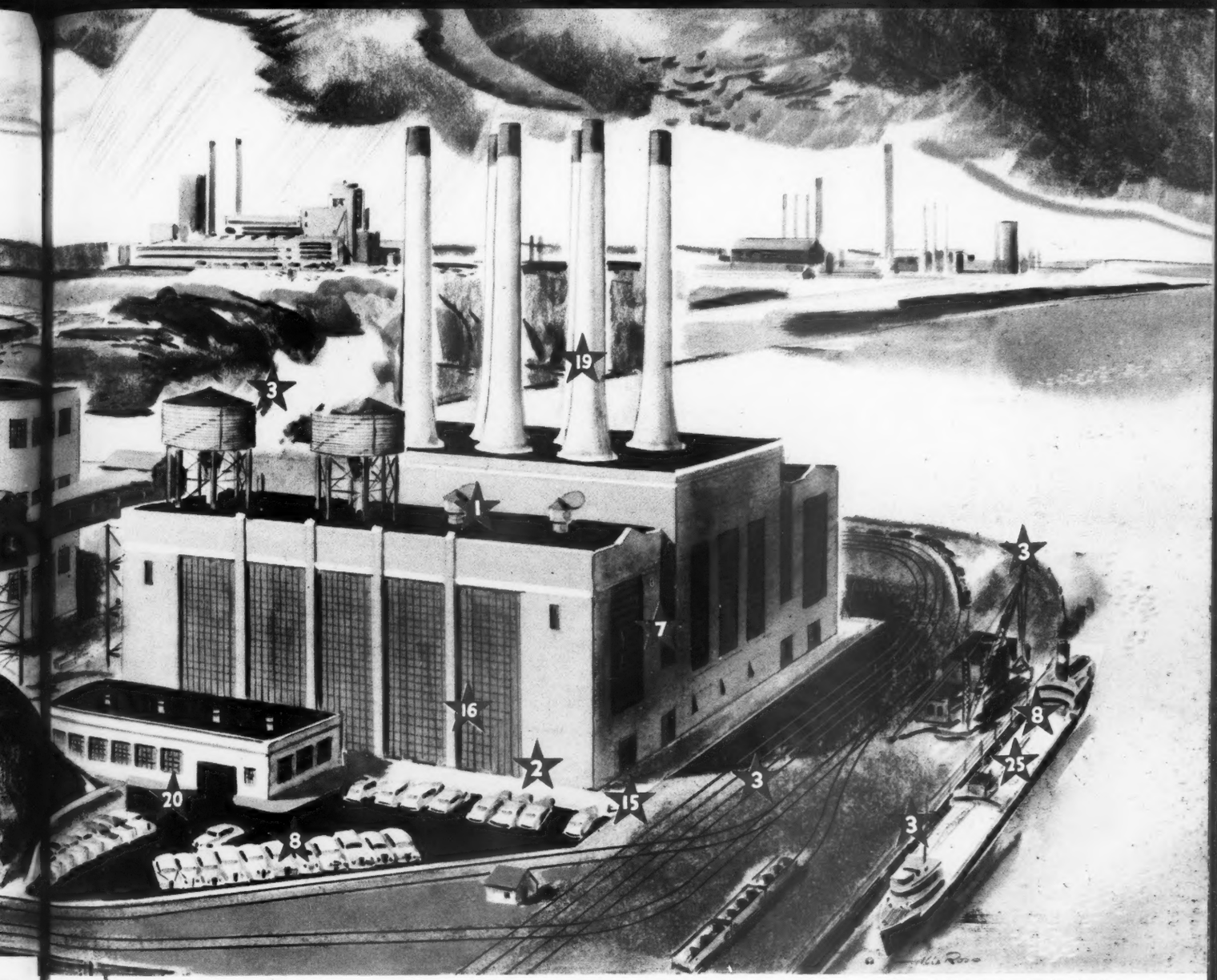
★1 Coal Tar Pitch Roofing ★2 Waterproofing and Dampproofing ★3 Pressure-treated Piling, Poles, Posts, Structural Timber, Ties, etc. ★4 Coal ★5 Coke ★6 Gas ★7 Fast's Self-aligning Couplings ★8 American Hammered Piston Rings ★9 Locomotive Cylinder Packing ★10 D-H-S Bronze ★11 Iron Castings ★12 Tanks, Tank Work, Plate Work ★13 Pipe ★14 Materials-handling Equipment ★15 Western Fire Hydrants ★16 Valves and Sluice Gates ★17 Waste Heat Boilers ★18 Bituminous-base Paints ★19 Lumino Bituminous-base Aluminum Paint ★20 Tarmac for Paving ★21 Disinfectants, Insecticides, Deodorants ★22 Tar Acids ★23 Light Oils ★24 Naphthalene ★25 Repair, Rebuilding, Reconditioning of Bay, Coastwise and Ocean Vessels ★26 Western Automatic Time Cycle Controls



★5 **COKE** . . . Koppers produces the highest quality of coke for heating and metallurgical uses. Koppers mines much of the coal which goes into its coke, built most of the modern coke plants in America and maintains strict laboratory control over all the processes of coke making.

★26 **TIME-CYCLE CONTROLS** . . . Koppers Western Time-Cycle Controls open and close process valves in pre-determined, easily-altered cycles to control the flow of fuel, air, steam, gas or liquids.

★2 **WATERPROOFING** . . . Recent investigations have shown that leaks in basements and tunnels, and deterioration of retaining walls, bridge floors, and other concrete and masonry structures can be prevented by the application of Koppers Waterproofing or Dampproofing when the structure is being built.



Drawn for Koppers Company by Alex Ross

20 PAVING MATERIALS . . . By using Koppers Tarmac road tars, roads, pavements, parking areas and other paved surfaces in and around your plants can be built more economically. Tarmac can be used with locally-available aggregates (gravel, stone, slag, etc.) and this is a large item of economy. Tarmac is also used on thousands of miles of main highways.

8 PISTON RINGS . . . American Hammered Piston Rings produced by American Hammered Piston Ring Division of Koppers Company, supply dependable service in every field where piston rings are used. Specialized for a wide variety of specific requirements, the rings are supplied in 18 different alloys and in a large number of designs.

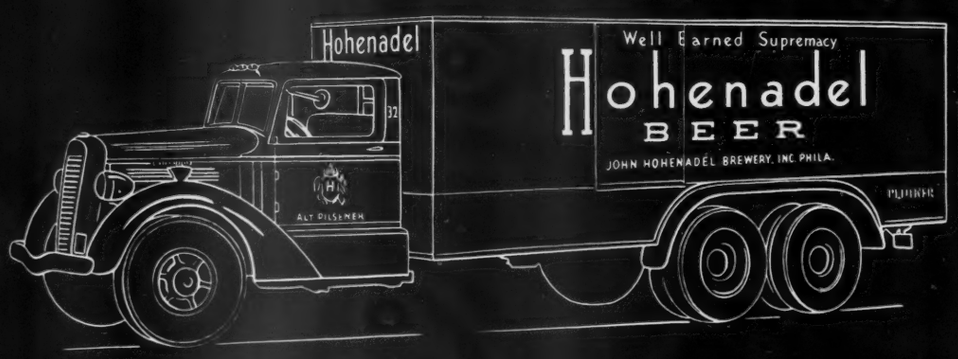
KOPPERS DIVISIONS, SUBSIDIARIES AND AFFILIATES

American Hammered Piston Ring Division · Bartlett Hayward Division Boston Tow Boat Company · Eastern Gas and Fuel Associates · Engineering and Construction Division · Gas and Coke Division · The Koppers Coal Company · Koppers-Rheolaveur Company · The Maryland Drydock Company · Mystic Iron Works · Mystic Steamship Company · National Lumber & Creosoting Company · New England Coal & Coke Company · Tar and Chemical Division · Western Gas Division · The White Tar Company of New Jersey, Inc. · The Wood Preserving Corporation

KOPPERS

SAVES HAULING COSTS ON 2,035 POUNDS....

A conventional truck body of this type weighs 5,300 pounds. Built of DYN-EL, it weighs 3,265 pounds . . . A saving of 2,035 pounds . . . Yet the body of DYN-EL costs no more.



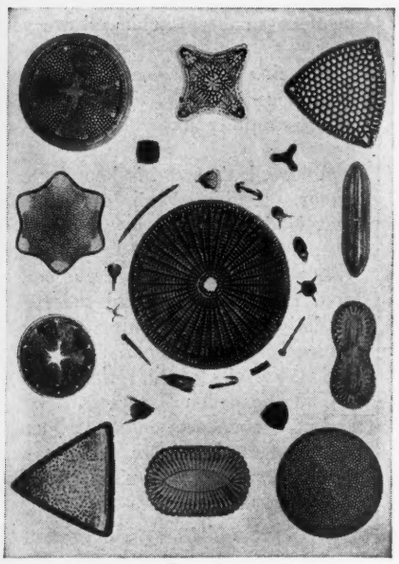
Truck body—225" long x 82" wide x 55" high. Built by Barry & Baily Co., Philadelphia, for John Hohenadel Brewery, Inc.

Dyn-el is 50% stronger than ordinary sheet steel . . . 60 to 150% more resistant to corrosion than copper-bearing steel (4 to 6 times ordinary steel). In the 48-page book, "A.W." Presents Dyn-el, you will find full details of savings in weight and cost possible with this new high-strength, flat-rolled steel . . . plus engineering and mechanical values. Diagrams, tables and charts cover a wide range of tests and properties. To executives, this book gives a quick picture of performance and costs. To engineers, it gives complete fabricating and design properties and table of sizes and weights. We will be pleased to send you a copy.

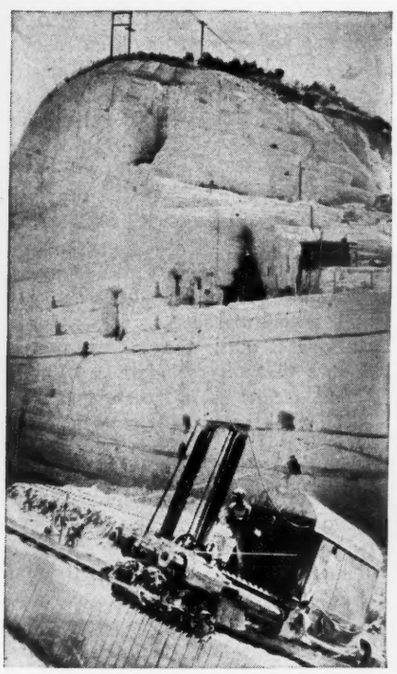
ALAN WOOD STEEL COMPANY

MAIN OFFICE AND MILLS, CONSHOHOCKEN, PENNSYLVANIA::SINCE 1826:: DISTRICT OFFICES AND REPRESENTATIVES—Philadelphia, NewYork, Boston, Detroit, Los Angeles, Seattle, San Francisco, Houston, Buffalo, Pittsburgh, Cleveland, Chicago, Cincinnati, New Orleans, St. Paul, St. Louis, Montreal. PRODUCTS INCLUDE—"A.W." Rolled Steel Floor Plates : : "Swede" Pig Iron : : Billets—Blooms and Slabs : : Sheared Steel Plates : : Hot Rolled and Hot Rolled Annealed Sheets and Strip : : Steel Products also furnished in Copper and Alloy analyses.

HOW TINY SEA PLANTS SAVE INDUSTRY MILLIONS OF DOLLARS EVERY YEAR



1 Under the microscope, diatoms present an amazing variety of intricately beautiful designs. Each is the skeleton of a complete single-celled organism that lived and died about 50,000 centuries ago. Settling to the ocean bed, these tiny plants built up a vast deposit of diatomaceous silica . . . one of the most efficient high-temperature insulating materials known today.



2 The Lompoc deposit of diatomaceous silica in California, owned by Johns-Manville, covers an area of five square miles and is 1400 feet deep. High-temperature insulations for many of the world's largest utilities and industrial plants have come from this chalklike cliff. More than 100 million tons of Celite are included in the deposit, the largest and purest ever discovered.

NEAR Lompoc, California, lies a vast deposit of Celite . . . one of the most useful substances known to man. Geologists call it "diatomaceous silica." It is porous, has a chalklike appearance and is unusually light in weight. Look at some of the powder under a powerful microscope and you will see what it really is . . . a mass of minute skeletons of tiny sea plants that lived and died millions of years ago when California was part of the ocean floor.

Up to about 1900, these tiny organisms served no useful purpose. Their peculiar properties were unknown . . . the need for them had not been developed. But with the increasing demand for more efficient industrial insulating materials, Celite soon was put to work. Tests showed that, because of its enormous number of dead-air cells and the high heat resistance of its silica composition, Celite was a far better insulating material for high temperatures than any substance previously used.

Today, Johns-Manville manufactures Celite into the well-known Sil-O-Cel materials—Sil-O-Cel Natural, C-22 and Super Brick, Sil-O-Cel Powder, and Sil-O-Cel C-3 Semi-Refractory Insulating Concrete. And, when bonded with asbestos fiber, Celite is also made into the widely used Superex Insulation for high-temperature industrial furnaces and superheated steam lines.

These and other J-M Insulations are now used wherever high temperatures are used in industrial processes. By preventing heat waste, they save industry many millions of dollars a year. The complete story of the remarkable strides made in controlling heat during the last 25 years is told in J-M's interesting handbook, "Heat." For your copy, and complete information on the full line of J-M Insulations for all industrial purposes, write Johns-Manville, 22 East 40th Street, New York, N. Y.

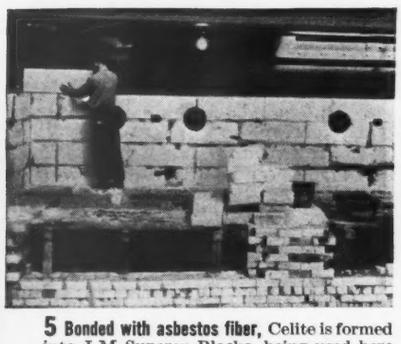
JOHNS-MANVILLE JM PRODUCTS

JOHNS-MANVILLE

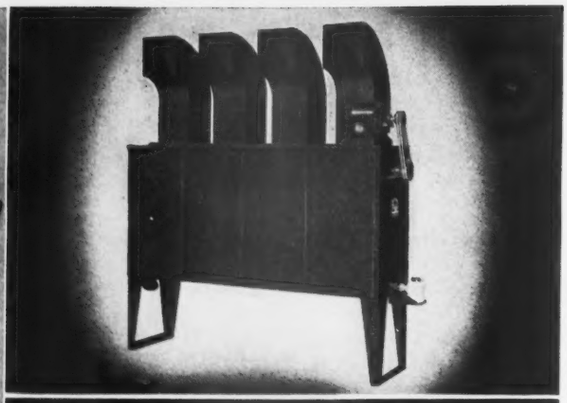
INSULATIONS FOR EVERY TEMPERATURE . . . FOR EVERY SERVICE CONDITION

3 One cubic inch of Celite from the Lompoc deposit contains as high as 75 million separate diatoms. This explains its exceptional insulating efficiency, as the resistance of any material to the flow of heat depends directly on the number of separate surfaces per inch of thickness. Johns-Manville makes this remarkably efficient insulating material into many different forms to meet every industrial requirement. This strip-annealing furnace is being insulated with J-M Sil-O-Cel C-22 Brick.

4 Made into semi-refractory insulating concrete, Celite is used for furnace bases and door linings, baffles, dampers, etc. Sil-O-Cel C-3 Concrete, shown here, is over three times as effective as fire-clay brick in reducing heat transfer . . . needs no other refractory protection against direct temperatures as high as 1800° F.



5 Bonded with asbestos fiber, Celite is formed into J-M Superex Blocks, being used here to insulate a soaking pit in a large Eastern steel mill. Superex, also manufactured in pipe-covering form, is recognized as the outstanding insulation for superheated steam lines, boilers and high-temperature industrial furnaces of every type. There is a J-M Insulation for every industrial requirement.



UNITHERM UNIT HEATERS

with Syncrotherm Control at No Extra Cost

Decidedly different is our principle of large space, industrial heating. We recommend Clarage Floor-Mounted UNITHERM Unit Heaters equipped with Clarage Syncrotherm Control. It is Syncrotherm Control (patented feature) which enables us to show such substantial savings in fuel cost.

With Syncrotherm Control the unit heater fans operate ALL the time during working hours, giving a continuous NON-STOP circulation of warm air.

To maintain any desired temperature, Syncrotherm Control regulates the amount of air passing THROUGH AND AROUND the heating coil. Marked economies in operating cost are the result. No hot ceilings — no cold floors! Syncrotherm Control makes Clarage UNITHERM Unit Heaters EASY on the coal pile.

Then, too, our floor mounted units utilize a very simple heating layout. There is invariably LESS piping and FEWER traps required — big saving in installation cost.

Before you buy, at least be informed on this latest factory heating development. Get a complete explanation of Syncrotherm Control by writing for Clarage FREE Bulletin 103.

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COMPLETE AIR CONDITIONING
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FANS & BLOWERS FOR INDUSTRIAL NEEDS

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Men who buy and use hack saw blades appreciate the convenience and blade-protection of the new hinged-lid metal boxes in which Victor Blades are packed. They welcome the advantages this improved packing method offers them — an addition to the known quality and lasting service of Victor "Moly" and Tungsten Blades.

The copyrighted boxes are handy even for odds and ends after the blades have been used.

VICTOR SAW WORKS, INC.
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"HAND AND POWER TUNGSTEN AND MOLY

"PACKED IN MODERN METAL BOXES

for length, tension, and freedom of operation in the holders.

4. A complete inspection is made yearly. Lubricating oil is changed in the bearings and the motor is cleaned thoroughly. Oil switches are drained, cleaned, and new oil is put in. Commutators, sliprings, rheostat contacts, fuse contacts, and all connections on the switchboard are gone over.

Cleaning of equipment is also done at various intervals, depending upon the conditions under which it operates.

A loose-leaf record is kept for each motor. It gives details of any work that is done on the motor, with the results of all monthly, quarterly, and yearly inspections. It is not considered necessary to record the results of daily inspections unless something unusual is done, or some unusual condition prevails at that time.

The effectiveness of this inspection and maintenance schedule is evidenced by the fact that there has not been a shutdown due to equipment failure during working hours for the past three years.

•

More Time for Welding, Less for Changing Cylinders

FRANK ELLWOOD, *Chicago*

Time required by acetylene welders to change from empty to full cylinders of gas and oxygen has been reduced in one plant by having an electric truck deliver to each workplace a box skid filled with cylinders set on end. Oxygen and gas cylinders are delivered on separate skids because it is not practicable to gage the supply so that both will be empty at the same time.

With this arrangement the welder can work continuously for a considerable period without stopping to change cylinders until the pressure gage shows that all cylinders are empty.

By means of a special manifold head and multiple connections the entire load of cylinders is connected up to the welder's hose line through a single set of valves and pressure regulators.

When he sees that the supply of either gas or oxygen is running low he signals the truck operator to deliver another load of cylinders, which is set alongside those still in use. As soon as the manifold is changed over to the full cylinders, the trucker removes the load of empties. The skid is then reloaded and set in a nearby storage space until needed.

At noon and night the individual cylinder valves are closed to prevent possible loss of gas by leakage.

COOL AS A DOG'S NOSE BOSS. ITS THAT ONE-PIECE COPPER THAT DOES IT
YOU SAID IT JOE. NOTHING BUT WESTINGHOUSE FOR ME FROM NOW ON AND THEY'VE SURE LICKED BEADED CONTACTS WITH THOSE DIAMOND POINTED JAWS, TOO

SIMPLICITY IN SAFETY SWITCH DESIGN MEANS LESS HEATING

One-piece copper parts in Westinghouse Safety Switches assure cool operation at all times — there can be no heating from loose connections.

And years of trouble-free service are assured by these added Westinghouse features: Diamond pointed jaws and extended blades confine beading to points outside the contact areas . . . the "De-ion" feature on all Westinghouse 575 and 600-volt switches quenches destructive arcs almost instantly.

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All commercial types and ratings. Call your local:

Electrical Wholesaler
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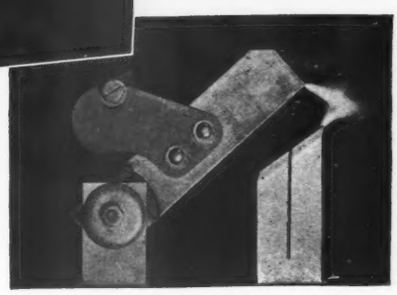
The exclusive Westinghouse diamond pointed jaw confines the bead to sections outside the contact area, sections which do not normally carry current.



WESTINGHOUSE ELECTRIC & MANUFACTURING CO., EAST PITTSBURGH, PA.

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Westinghouse *Safety Switches*

MOTORS • CONTROL • CIRCUIT BREAKERS • SAFETY SWITCHES • PUSH BUTTONS

The greatest need of the industrial power plant is modernization to cut the present preventable waste of six or seven hundred million dollars yearly in the generation, purchase, internal distribution and application of power services.

Philip W. Swain

Philip W. Swain, Editor of Power

A $600,000,000 CHALLENGE TO INDUSTRY

To meet this challenge, you must keep up with the latest developments and equipment.

You can actually see the newest and best equipment for cutting the cost of power applications, understand its principles and applications, know how to operate it, know where and when to use it. That opportunity is yours at this year's National Power Show —the 13th National Exposition of Power and Mechanical Engineering. Here you can examine, compare, and discuss with exhibitors' engineers every one of the many hundreds of items that will be shown on three floors of Grand Central Palace, New York, the Exposition Capitol of the World.

More than 40,000 engineers are expected to attend. Be sure to come. Bring your associates. Don't miss it!

13TH NATIONAL EXPOSITION OF POWER AND MECHANICAL ENGINEERING

GRAND CENTRAL PALACE

NEW YORK

DEC. 5-10, 1938

Management International Exposition Company

When you Need Small Motors

(*Continued from page 77*)

function to open the circuit, both from sustained high currents and when the temperature rises beyond safe limits from any other cause.

Insulation. Various types are provided to resist certain physical conditions.

Standard, general-purpose insulation should resist mild acids and alkalis as encountered in ordinary industrial processing; abrasives, such as iron dust, from ordinary machine shop operations, and moisture conditions on appliances placed in damp basements. Special insulations for more severe conditions are available.

In summarizing the importance of these motor factors, it should be borne in mind that the design engineer can make any one of them predominant, but only at the expense of some other factor. The best design is obtained by the proper balance of all these factors.

Chart Aids Selection

So far motor factors have been considered mostly from the point of view of application requirements. After the requirements have been defined the accompanying chart describing the important characteristics of the different types of motors will be helpful in selecting the one best suited to the application.

Locked-rotor current is the current required to produce the static torque. The repulsion-start, induction-run motor produces a static torque of 550 per cent of normal with a locked-rotor current of 13 amp. This is the highest starting efficiency found in any of the single-phase motors. The split-phase motor develops a static torque of 230 per cent of normal with a locked-rotor current of 32 amp. giving the lowest starting efficiency of any of the motors described.

These figures do not mean that one type is bad and the other is good. It *does* mean that the repulsion-start motor will start a heavy load, whereas the split-phase motor should be used only on easy-starting loads.

All these requirement factors and a description of the various motor characteristics plainly indicate that the big problem is to get the load started without too much line disturbance. So far as running characteristics are concerned, all the single-phase motors, except the capacitor-start and capacitor-run motor, operate on the same single-phase, induction motor principle; therefore the running factors are somewhat similar.

The single-phase, capacitor-start, capacitor-run motor has higher efficiency and power factor, and is the quietest running of all the single-phase motors. Polyphase and d.c. motors are used where the corresponding current supplies are available. These motors will perform any task the best single-phase motor can do.

How Much Electric Heat?

(*Continued from page 80*)

for the average insulating material used in ovens, and 90 deg. F. outer surface temperature. This outer temperature will vary with the inside temperature.

Kw.-hr. $= (A \times T \times K \times F) \div (I \times 3{,}412)$

Where A = Total inside area of oven in sq.ft., including floor

T = Temperature difference between inside and outside of oven

K = A constant based on the B.t.u. loss per hour per sq.ft. per inch of thickness of oven walls

F = Factor of safety

I = Wall thickness in inches

Substituting, $[376 \times (460 - 90) \times 0.5 \times 3] \div 4 \times 3{,}412 = 15.28$ kw.-hr.

3. Heat absorbed by the material is found by the formula:

Kw.-hr. $= (W \times S \times T) \div 3{,}412$

Where W = Weight of material in pounds

S = Specific heat of material to be treated. For iron $S = 0.12$

T = Temperature rise

Substituting, $[400 \times 0.12 \times (460 - 70)] \div 3{,}412 = 5.48$ kw.-hr.

Total capacity of heaters required is:

Energy required to heat air	5.97 kw.-hr.
Energy lost by radiation	15.28 kw.-hr.
Energy absorbed by material	5.48 kw.-hr.
	26.73 kw.-hr.

If 27 kw. of electric heaters is installed, this oven will meet the specifications for this job.

For heating water and other liquids,

Have you heard that you can reduce bearing failures and cut maintenance costs by periodically lubricating machines the Lincoln way?

It is no wonder so many maintenance men are specifying

LINCOLN

INDUSTRIAL LUBRICATING EQUIPMENT

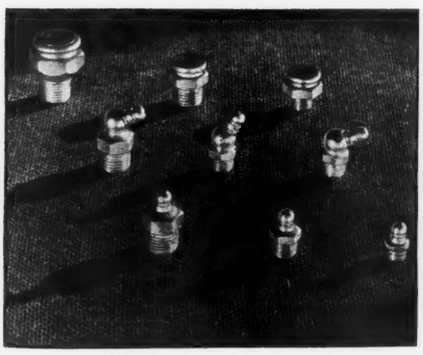
A complete line of KLEENSEAL fittings, hand guns and power operated dispensing units

YOU, TOO, can eliminate expensive bearing failures, and can save both time and money with the aid of Lincoln Lubricating Equipment.

There is no need for you to gamble, when it is so easy and inexpensive to be sure with Lincoln. The proven performance of this equipment is a matter of record.

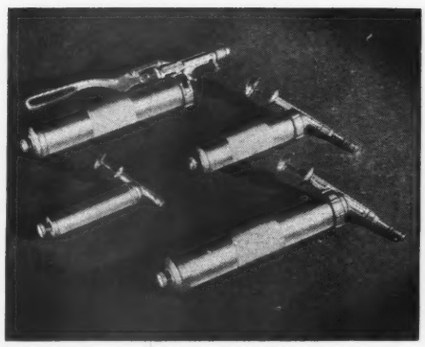
The complete industrial line manufactured by Lincoln includes grease lubricant dispensing equipment ranging from small hand guns to a full line of heavy duty units operated by electric motor or compressed air. Many models are available for dispensing directly from original 25 lb., 100 lb. and 400 lb. containers. Lincoln also makes a full line of KLEENSEAL and Button Head Fittings for replacement and modernization needs.

Learn more about what Lincoln has to offer by requesting a copy of Catalog No. 60 . . . Why not ask for it today!



Lincoln KLEENSEAL and Button Head Fittings in all types and sizes are available for replacement and modernization needs.

An Electric Lubrigun dispensing from original 400 lb. drum.



A few of the many types of hand operated Lincoln Grease Guns are shown above. The complete line is shown in Catalog No. 60.

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PIONEER BUILDERS OF LUBRICATING EQUIPMENT

GENERAL OFFICES, ST. LOUIS, MO. FACTORIES: ST. LOUIS, MO., DETROIT, MICH.

Take the Acrobats Off YOUR Payroll

A Dayton Safety Ladder eliminates the need for acrobats because they are scientifically constructed to eliminate tipping and wabbling. Workmen know that they can work with both hands, even from the topmost platform, without fear of falling.

Daytons will help you save on labor and accident costs. As Daytons last much longer than ordinary ladders, they will likewise reduce your ladder costs.

Dayton Safety Ladders are made of airplane spruce—light and strong—in sizes 3 to 16 feet. Moderately priced.

Write Dept. FMM-9 for details.

THE DAYTON SAFETY LADDER CO.
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DAYTON Safety Ladder
(Patented)

Send for our catalog No. 5, showing complete line of the latest accident prevention equipment.

Do Fast, Accurate Work at Low Cost With the JOHNSON No. 118 Combination Bench Furnace

This powerful and versatile furnace gives you efficient heating of the largest soldering coppers and branding irons; tempering, annealing, case hardening, and melting of soft metals. Note the side doors to enable you to heat long rods and sweat pipe joints. The removable pot holds 22 lbs. of lead. Refractory firebox lining and detachable baffle plate assure uniform heat. Three Direct Jet burners give intense heat without a blower or forced air blast. Write for free catalog today.

JOHNSON GAS APPLIANCE CO.
Cedar Rapids IOWA

the electric method is the most efficient because use can be made of a heater immersed directly in the water, with direct heat transfer. All the heat in the heating unit goes directly into the liquid, with practically no loss.

When used in oils, pitch, or compounds, the surface area of immersion heaters must be practically doubled for the same wattage rating. This is because such materials are easily carbonized by high heat. With electrically heated kettles for heavy oils and similar materials, it is better to use radiant heaters applied to the outside surfaces; they will give longer life, with much less chance of carbonization.

All liquids are heated by convection; that is, movement of the heated portion by the difference of weight between the hot and cold portion creates the circulation necessary to heat the entire mass.

Determining Heat Required

To calculate the kilowatts of heat required for liquids, it is necessary to determine: (1) The amount of heat to bring the liquid to the desired temperature from a cold start in a given time; (2) the amount of heat required to keep it at the operating temperature. This figure must include the heat absorbed by any material put into the liquid, for example, pieces of steel in an oil bath.

To determine the amount of heat required to bring the liquid to the temperature wanted, use the formula:

$$\text{Kw.-hr.} = (W \times S \times T) \div 3{,}412$$

Where W = Weight of liquid in pounds
S = Specific heat of the liquid
T = Temperature rise (desired temperature minus room temperature)

To this result add 20 to 30 per cent more wattage to replace losses. Note that this result is expressed in kilowatt-hours, which means the kilowatts needed to bring the liquid to temperature in 1 hour. If more time can be allowed, divide the kilowatt-hours by the number of hours allowable; the result will be the kilowatt capacity of heaters needed.

To know how much heat is needed to keep a tank of liquid at its operating temperature, it is necessary to calculate the losses. Furnishing enough heat to compensate for these losses will maintain the temperature constant. These losses mean the heat that will get away by radiation, convection, and conduction from all surfaces that are in contact with the liquid. An approximate figure for average losses from tanks is 0.6 watts per hour per square foot from all surfaces for each degree Fahrenheit difference in temperature. The temperature used is the difference between that in the tank and the ambient temperature.

Excess Capacity Won't Hurt

When heating liquids, as with other electric heating applications, it is always desirable to control the temperature with a thermostat. When in doubt as to the kilowatt capacity required, remember that it is better to use too much, rather than too little. An excess of capacity will not consume more power in kilowatt hours if controlled with a thermostat, because greater heat output simply means that a shorter time is required to reach the temperature wanted.

Watch the voltage of the power supply. The wattage of a heating unit varies as the square of the voltage, which means that for any change in voltage there is a proportionally greater change in wattage. For example, if a 2,000-watt, 230-volt heater is operated on a line that drops to 220 volts, it will deliver heat equivalent to only 1,829 watts. And if the line should drop to 210 volts, it would be good for only 1,667 watts.

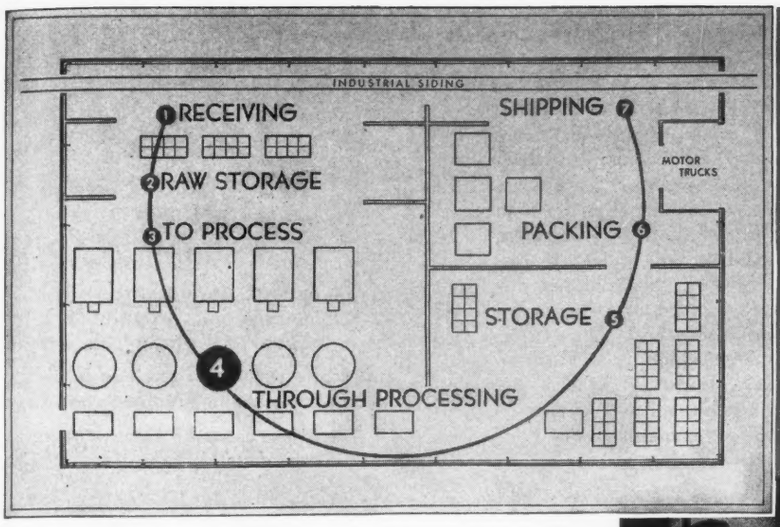
Conversely, overvoltage will overload the heaters. That is, a 2,000-watt, 220-volt heater operated on a 240-volt line will consume 2,380 watts.

If Electronic Devices Give Trouble

(*Continued from page 75*)

Shooting trouble is the most difficult phase of maintenance work on electronic apparatus. This is largely because in an electronic circuit there is little visual evidence of what is taking place. Considerable reliance must be placed upon the knowledge of how a tube should operate as outlined in the tables in this and the preceding article. Also, a great deal of the success in finding trouble quickly depends upon the use of adequate test equipment. Much time can be saved by check measurements and deduction of what must be causing the trouble. If any considerable amount of electronic equipment is to be maintained, suitable test instruments are indispensable.

The instruments required for adequate testing of electronic equipment differ from those normally used by



DO YOUR MATERIALS *Flow,* OR JUST *Wander,* THROUGH PROCESSING?

1. **Car to Receiving**
2. **Receiving to Storage**
3. **Storage to Process**
4. **Through Processing**
5. **Process into Storage**
6. **Storage to Packing**
7. **Packing into Car**

Every Production Executive knows that even the most modern equipment cannot earn to capacity unless it is kept *continuously busy.* In other words, that the movement of work from one machine to the next must make good connections all the time.

Yet Elwell-Parker Engineers are constantly in consultation with concerns that apparently forget that production machines *must be served both ways continually* before they can even *begin* to earn. First, by a steady oncoming flow of parts from the preceding process; second, by adequate removal of those parts to the operation next ahead.

Use Elwell-Parker's experience to help you *organize* the movement of your materials so that they will arrive on time at each step of your Processing. Learn how Elwell-Parker Systems of Plant Transportation* have eliminated waste and reduced costs materially throughout other plants, and doubtless can do as much for you. (See the 7 Steps listed above.)

Long-standing, costly wastes in materials handling are going unnoticed today in thousands of plants—merely because Executives have come to take them for granted. Wouldn't you do well to look for such wastes in *your* load-handling methods? An Elwell-Parker Engineer will gladly join you in a preliminary survey. The Elwell-Parker Electric Company, 4323 St. Clair Ave., Cleveland, Ohio.

** The Elwell-Parker System of Materials Handling combines suitable types of Elwell-Parker Trucks, Tractors or Cranes with attachments as required to do a practical job.*

ELWELL-PARKER *Power Industrial* TRUCKS

ESTABLISHED 1893 • BUILDING POWER INDUSTRIAL TRUCKS SINCE 1906

The BROWNING CRANE & SHOVEL Co.
ESTABLISHED 1899
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40 YEARS OF LEADERSHIP
CRAWLER, TRUCK AND WAGON SHOVELS DRAGLINES CRANES • HOES
BROWNING PRODUCTS
DIESEL GASOLINE STEAM ELECTRIC
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For Better Service—
INSTALL TRICO
REG. U.S. PAT. OFF.
RENEWABLE FUSES
With the famous powder-packed element
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With genuine fibre tubes (not paper)
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Color tells the size
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With built-in thermal time-lag element
KLIPLOK CLAMPS
Lock fuses and clips together
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For motors, line shafts, etc.
Send for your new Folder CPF-300 TODAY!
TRICO FUSE MFG. CO., MILWAUKEE, WIS.
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TRICO POWDER PACKED FUSES
STOP WASTED KILOWATTS AND WASTEFUL SHUTDOWNS

maintenance men for testing motors and other power apparatus. The major difference lies in the fact that the current required in the control circuit of electronic tubes is very small; therefore the impedance of resistors, capacitors, and reactors is relatively high and may be several megohms. In many instances the currents involved are on the order of microamperes, very frequently only milliamperes. Voltages which must be measured are often supplied from a weak power supply and hence require the use of a voltmeter which draws little power.

Table II lists a typical set of instruments that will serve most requirements in testing electronic equipment. This list of instruments is rather imposing, and of course in many cases they cannot be justified. However, they should by all means be available if the amount of apparatus involved is considerable, or if continuity of service is of the utmost importance. The ohmmeter and various ranges of a.c. and d.c. voltmeters are most important, and are relatively inexpensive. The more expensive items such as the insulation-resistance meter, cathode-ray oscilloscope, and microammeter should be added to the test equipment as soon as they can be justified.

Where Trouble Comes From

Since so many of the failures of electronic equipment do not produce effects which can be visually interpreted, the following tabulation of the various ways in which trouble evidences itself and the possible causes of it will be of assistance in tracing difficulties:

1. Erratic performance:

(*a*) Defective tube (insert known good one).

(*b*) Loose connection

(*c*) Intermittent open in resistor.

(*d*) Intermittent short circuit in capacitor or transformer.

(*e*) Hairline adjustments (this is an important factor).

(*f*) Too-low or too-high temperature of mercury-vapor tubes.

(*g*) Electrical pickup on exposed leads.

(*h*) Electrical leakage on sensitive circuit.

(*i*) Optical systems, when involved, usually are not troublesome when once properly applied, but if not periodically cleaned will cause erratic operation.

2. Tubes refuse to conduct current:

(*a*) Failure of tube.

(*b*) Open circuit, fuses, or switches.

(*c*) Failure of positive grid voltage source.

(*d*) Short circuit or high-resistance leakage in the grid circuit.

(*e*) Failure of ignitor in Ignitron tube.

3. Tubes conduct current continuously—refuse to stop or control:

(*a*) Short circuit in grid circuit or high-resistance leakage.

(*b*) Failure of negative voltage source for grid.

(*c*) Faulty tube (trouble may be caused by leakage of gas into a tube, or failure of vacuum pumping system.)

4. Tubes lose control occasionally and pass current in the absence of a controlling impulse:

(*a*) This condition is related to erratic performance.

(*b*) A very frequent cause is electrical pickup on exposed, high-impedance leads. Voltage surges when motors are switched on the line may also be the cause. It may often be avoided by checking and eliminating hairline adjustment, which results in excessive sensitivity to such conditions.

5. Short tube life:

(*a*) Overload in amperes, voltage, or a too-high duty cycle.

(*b*) Too high or too low filament voltage.

(*c*) With mercury vapor tubes, excessively hot or cold ambient temperatures.

These suggestions for locating trouble have been approached from general considerations. Specific apparatus has its own peculiarities, depending on circuit details. A detailed analysis of a typical device may prove of value in pointing the way to the causes of the troubles that are most commonly found.

Counter Not Working

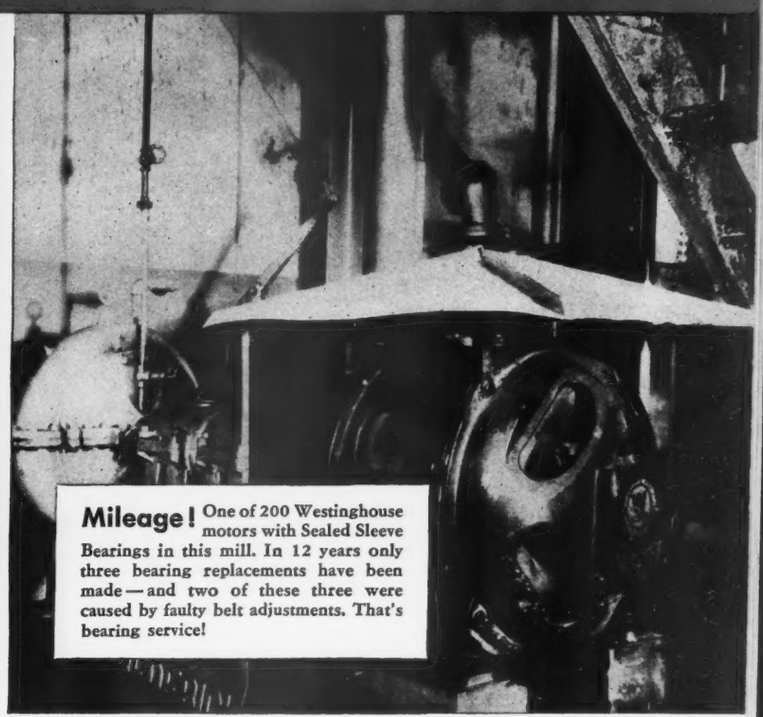
Assume that a photoelectric counter on a conveyor is reported inoperative. Table III shows the more common troubles in the approximate order of likelihood. The analysis relates specifically to the circuit in Figure 1, which is typical.

It is conceivable that many failures can occur other than those charted, but the more likely ones have been shown. Possibilities such as open resistors and transformers or shorted circuits have been omitted since these are usually readily detected by means of a voltmeter and ohmmeter, by checking circuit constants against the values given in the instructions. For this purpose the instruments listed in Table II are indispensable.

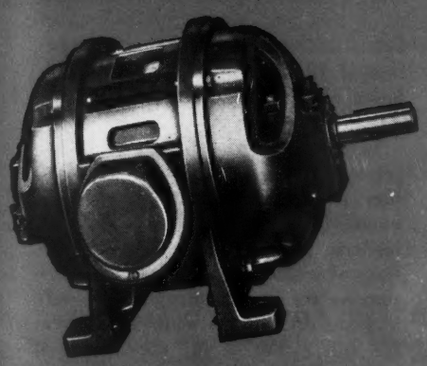
Consider "Mileage" First...

IN BUYING AN ELECTRICAL MOTOR

Mileage! Grimy with oil and metal filings thrown off by a cold cutoff saw, but this motor has been in continuous service for over eight years. Original windings and bearings are still on the job.



Mileage! One of 200 Westinghouse motors with Sealed Sleeve Bearings in this mill. In 12 years only three bearing replacements have been made — and two of these three were caused by faulty belt adjustments. That's bearing service!



Convert the turning action of an electric motor into distance — you will be amazed at the mileage piled up during its lifetime. Extra years of service, extra mileage is built into Westinghouse motors.

The big difference in different makes of motors is not in the appearance outside — it's in the features inside. That is where Mileage is built.

And that is where Westinghouse — and only Westinghouse — has perfected the three essentials to mileage — to extra years of trouble-free service.

1. **TUFFERNELL INSULATION:** Dual protected windings and taped end turns give extra protection against mechanical and electrical damage.
2. **SEALED SLEEVE BEARINGS:** Exclusive Westinghouse bearing seal keeps clean oil in; seals dirt, dust and grit out.
3. **RIGID ONE-PIECE FRAME:** Mechanical parts carry the mechanical load, protecting electrical parts from vibration, torque and strain.

For full details on all types and sizes, simply call your nearest:

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FROM POWER LINE TO DRIVEN MACHINE
YOU ARE ALWAYS SURE WITH

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MOTORS * CONTROL * CIRCUIT PROTECTIVE EQUIPMENT

Sweden's Labor Contracts

(*Continued from page 48*)

processes and manufacturing methods.

Skilled workers in the metal trades in Norway averaged, in 1937, 1.63 crowns per hour; laborers in the same trades, 1.31. (The crown, both Norwegian and Swedish, is worth about 25¢ American money.) In Sweden, skilled workers in the metal trades now earn on the average 1.60 crowns per hour; unskilled, 1.30 crowns. The rates are for Stockholm, and are higher than in other cities.

These rates seem very low to Americans. But competent observers report that the standard of living of the workers in Norway and Sweden (and in Denmark) is the highest in Europe. The explanation lies in the low cost of living.

Incidentally, one labor leader, discussing his own trade, said: "We are getting as high wages as our industry on the average can afford to pay." This is the first time in nearly a year of labor investigation that I have heard such a statement.

American employers and wage earners will note the relatively small margins for skill in the wage rates quoted. One is inclined to wonder whether a worker will take the trouble to learn a trade. The answer is that Scandinavian workers consider that the reward for skill is not alone in money, but even more in prestige and social position. There is no material shortage of those entering the skilled trades, although the growth in production has been so rapid since the World War that the larger companies, particularly in Sweden, have set up training courses for mechanics.

The work week in both countries is, in general, 48 hours. Overtime rates generally are time-and-a-quarter for the first two hours, time-and-a-half thereafter, double time on Sundays and holidays. There are definite limits to the amount of overtime a man may work.

Vacations With Pay

In Norway every worker gets an annual two weeks' vacation with pay, 9 of the 12 days being provided by law, the other 3 by an agreement of the federations. In Sweden the agreements have generally provided for 5 or 6 days' vacation with pay. However, a new law passed by the Parliament this year comes into effect in 1940, under which an annual vacation of 12 days with pay will be allowed all workers who have been employed the full year.

In general, Swedish employers express satisfaction with their conciliation procedure, though it was frequently pointed out—and by labor leaders, too—that on the big questions of wages and hours private negotiations are now, in many trades, only a gesture. Neither side will reveal the full extent of the concessions it will make, for it is morally certain that the issue will go to conciliation.

In both countries, the employers testified that the labor leaders were hard bargainers—able, intelligent, strong men, not easily diverted from their goal. They are willing to accept facts, once an economic situation has arisen and is perfectly plain, but they have to see figures of what has happened rather than estimates of what may happen. The employers were realistic enough, however, to admit that the leaders are not in an easy position. Back of them is an unusual intelligent group of union members, with all the strength and determination of the Scandinavian character. No resentment was expressed against the unions or the leaders, although in Norway it was

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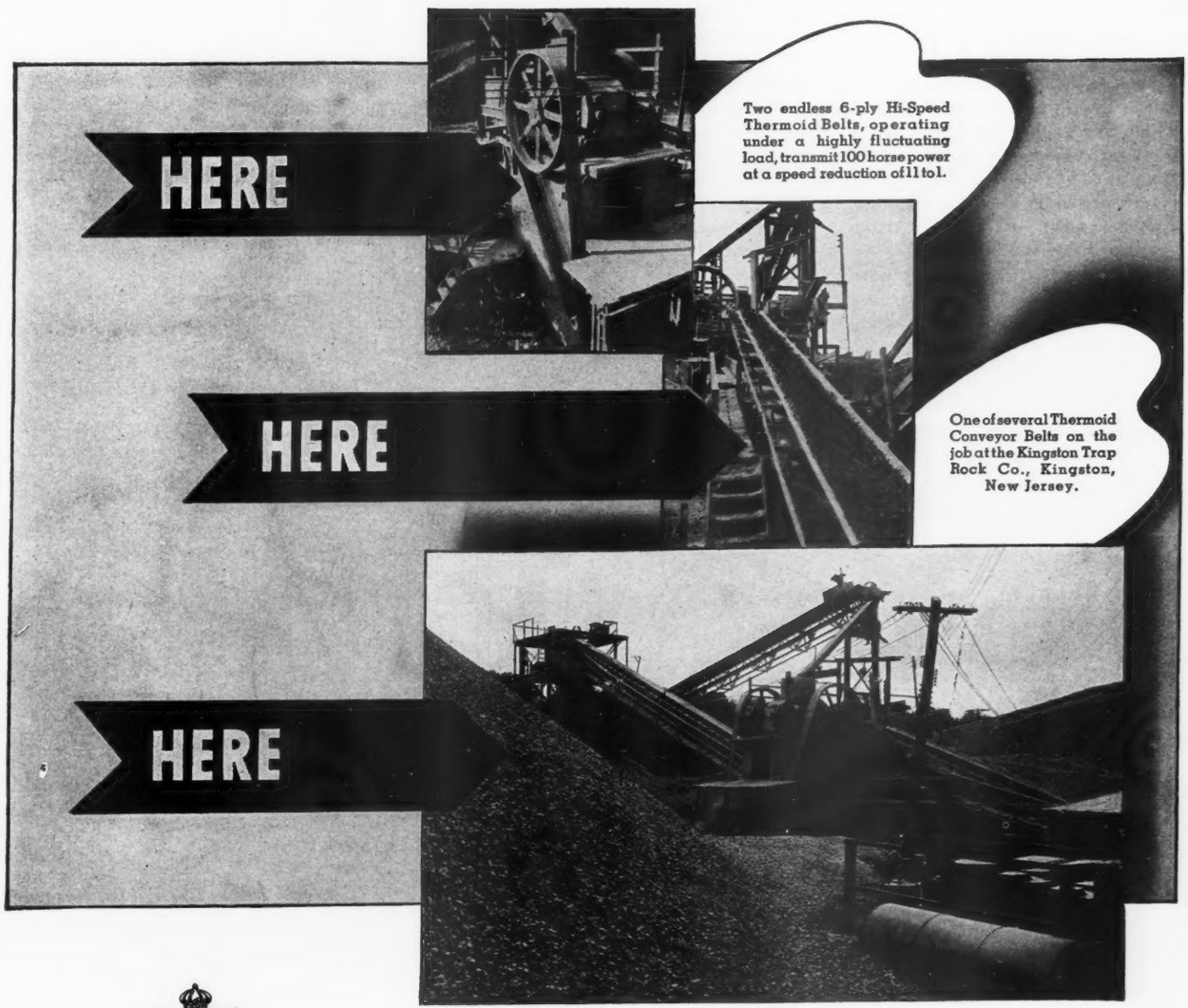
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Has ideal combination of great strength and high flexibility. A type for every purpose and service.

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Another important Thermoid user, the Kingston Trap Rock Company, gives an excellent example of Thermoid's complete service to industry. Besides conveyor belting and transmission belting for the modern crusher illustrated, Kingston Trap Rock Company's 1937 purchases of Thermoid Products included air hose, steam hose, suction hose, and brake lining.

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plain that the employers felt the unions were pushing too hard.

In Sweden this feeling was not in evidence, although one shrewd observer believed wages had been pushed too high and doubted that the present wage level could be long maintained.

Both Sweden and Norway have been very prosperous in the last two years. Wages have gone up sharply. At the same time there have been no serious labor disturbances. At another time, say one of slow trade and increasing labor disturbances, the replies might not have been so happy.

An American inquirer, remembering some of our own experiences with organized labor, naturally asks whether such nearly complete unionization as they have in these countries, particularly when accompanied by equally strong organization of employers, does not tend to throw the groups into two militant camps, setting up antagonism between workers and managers in the plants themselves. Apparently there *is* this tendency. Some employers feel it keenly, and stated that the union leaders in their particular industries discouraged the men from friendly relations with the managers.

However, this was not the *prevailing* opinion, at least not in Sweden. There it was emphasized that the attitude of the workers is a reflection of the management. Be friendly towards the men, and they will respond with friendliness. Be harsh and distant, and they will respond in kind.

The next point involves what every American employer regards as a principle. It is the question of the closed or the open shop. *In neither of these countries do they have closed-shop agreements.* But the circumstances differ.

Open Shop Fundamental

In Sweden the open shop is part of the fundamental agreement between the two big federations. The employers' federation agreed to recognize the unions on condition that they (the employers) would have the right to employ and discharge whom they would. This the unions accepted.

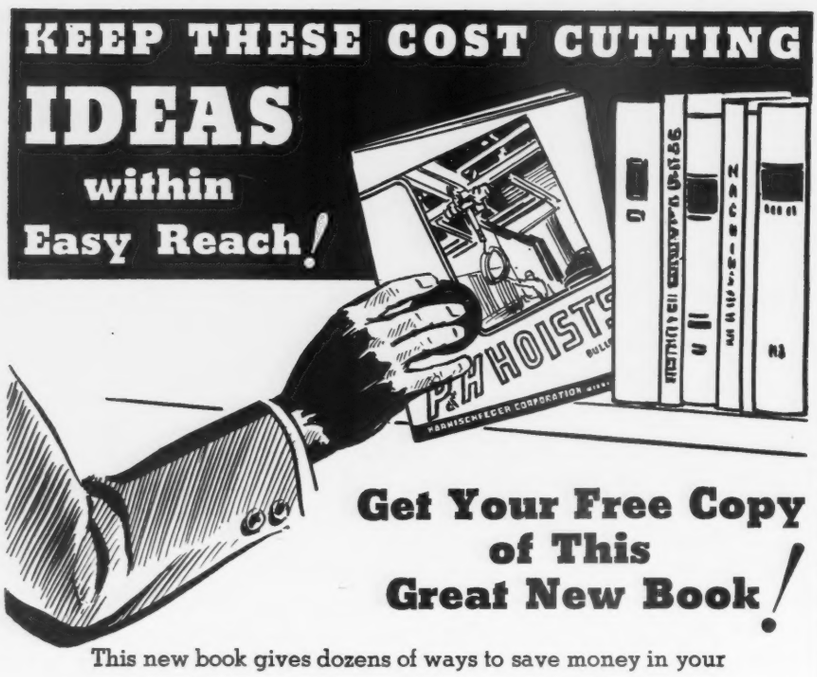
Needless to say the right to discharge is not ruthlessly exercised. Swedish employers are not of that type. And an employer may not discharge a man for union activity, nor, when he is hiring men, discriminate against unionists because they are active in unionism. This holds true also in Norway.

Employers proceed very carefully when dismissing men. The union is quick to charge that the dismissal is because of union activity. In case of inefficiency, therefore, it is common practice to warn a man first that his production is unsatisfactory, and to notify the union representatives at the same time. If there is no improvement, the warning is repeated. If again there is no improvement, discharge follows, generally without union objection.

When reduction of available work requires dismissal of men, the unions fight for the seniority principle. But the Labor Court has refused to support them. However, all else being equal, the employer *does* respect seniority—that is, between men equally valuable to the organization.

In Norway, a most interesting situation has developed. *The Trade Union Congress has declared in favor of the open shop.* The reason—they want to be free to admit or to deny admittance to their ranks as they please. They do not want fascists or strike breakers. If they had closed shop agreements, they would have to take in everybody. Otherwise they would, by refusing to accept man, deprive him of the right to earn a livelihood, or at least curtail it very considerably.

While employers in both countries do not inquire whether a man is a unionist or not, they do get almost



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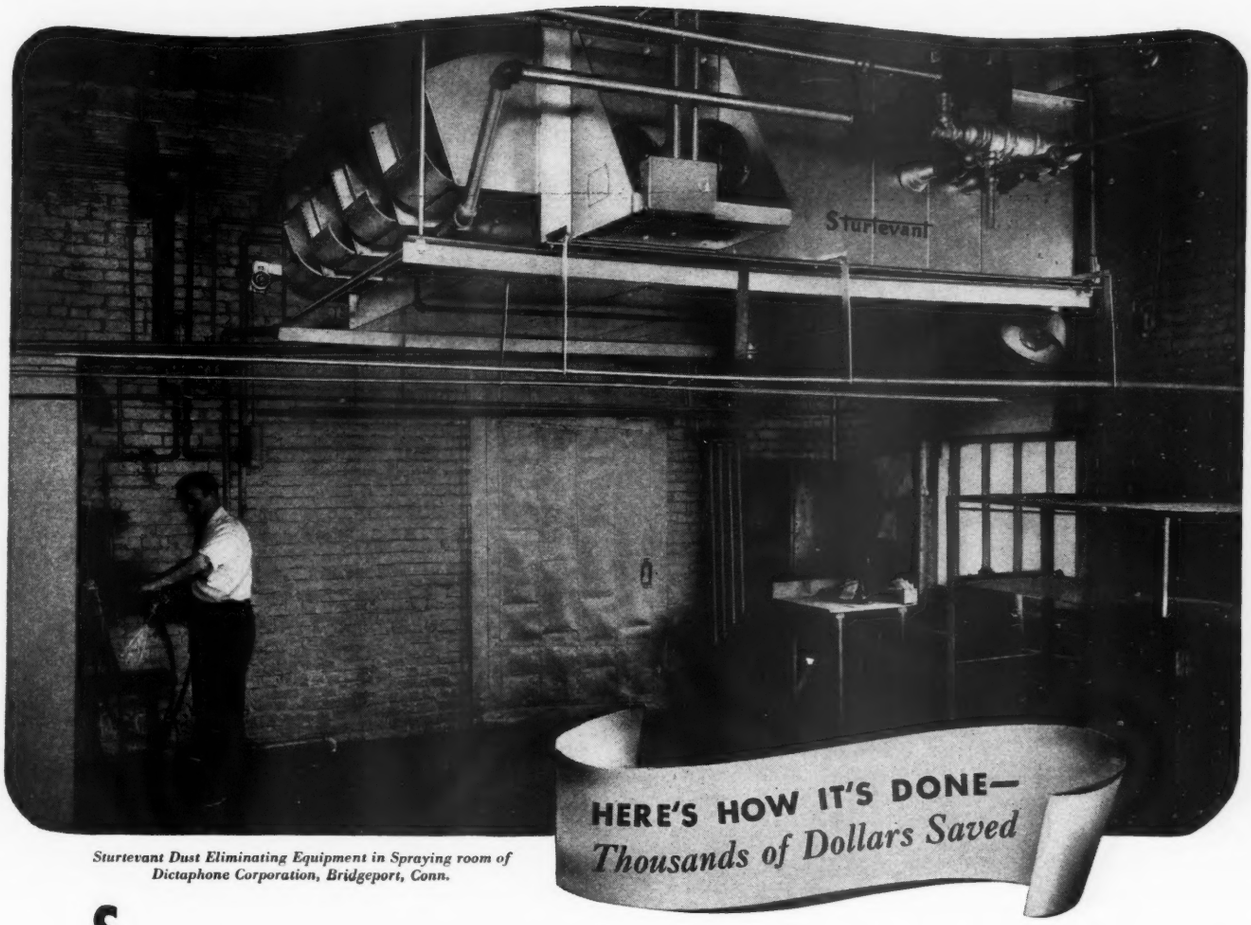
PREVENT COSTLY SPOILAGE

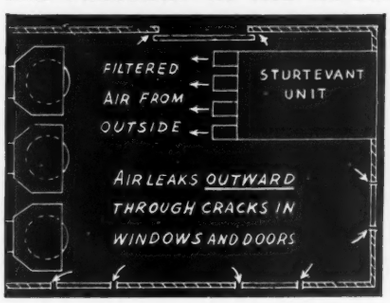
by Dust Particles in Spraying Rooms



Sturtevant Dust Eliminating Equipment in Spraying room of Dictaphone Corporation, Bridgeport, Conn.

SPOILAGE in spraying rooms, caused by dust particles which impinge on freshly japanned and lacquered surfaces, is costing some manufacturers thousands of dollars annually. But such losses can be, and have been, eliminated ...through the installation of Sturtevant Dust Eliminating Equipment.

DUST-FREE AIR BUILDS UP AIR PRESSURE IN THE ROOM



Ordinarily, dust-laden air leaks into the spraying room from other parts of the plant and through cracks in windows and doors. With this Sturtevant Dust Eliminating Equipment on the job, however, this condition is overcome.

Air is drawn in from the outside, thoroughly filtered, and then discharged into the spraying room in a dust-free state. This air not only compensates for air exhausted from the spray booths but is sufficient to build up a definite pressure in the room, causing the air to leak *outward* through cracks in windows and doors and preventing *inward* leakage of air.

These Sturtevant Dust Eliminating Systems are now successfully operating in a number of plants. Their use has greatly reduced rejects, resulting in very large savings. In fact, their initial cost usually can be readily offset by the savings effected in one year or even less.

For further information regarding this money-saving equipment, simply fill out and mail the handy coupon.

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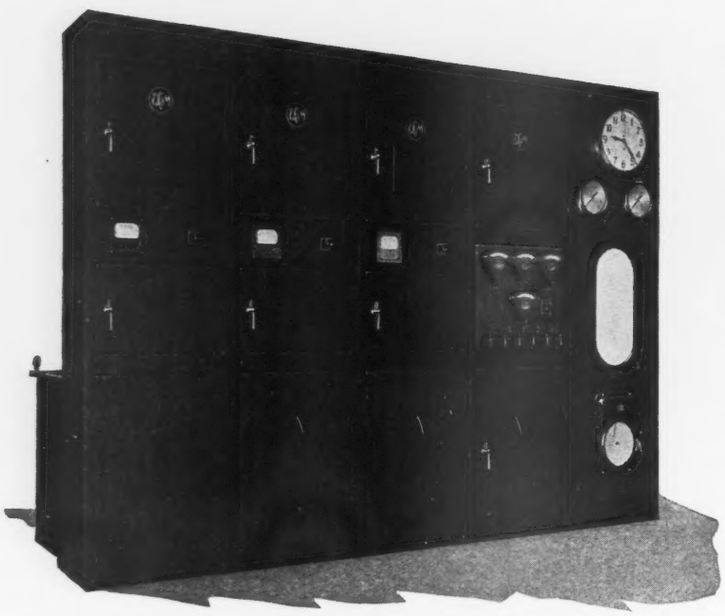
entirely a union force. Such is the strength of unionism in these countries. If a man is not a member when employed, he is very likely to join promptly, unless, in Norway, the union has objection to him.

Here, then, in Norway and Sweden, is at least one labor practice that is likely to appeal to many American employers—enforceable labor agreements. The other outstanding feature—compulsory conciliation—would not, in our present frame of mind, be popular in America. We shy at any type of government intervention. But the Swedes and Norwegians, having proceeded far in their social thinking and practice, do not resent such intervention. They say it works (given their standards of governmental administration) without political prejudice, bias, or subservience.

But their whole system rests, of course, on something we are not ready to accept—recognition of the desirability of strong and responsible organization on both sides, and bargaining at one time for all the employers in an industry.

Shall we come to this? Most of the rest of the industrialized world already has.

EC & M *Steel-clad* Motor Control



3-Motor, 4160 Volt, Dead-Front Control

for Fully Automatic Pumping Station . . .

LOOK at the neat, orderly arrangement of this EC&M Motor Control Equipment of Steel-clad construction. It has every advantage of safety and convenience. Doors are interlocked to prevent pulling disconnect switches under load and the dead-front construction provides a shock-proof installation.

Oil-immersed starters, designed especially for high voltage service, are mounted at the rear with front compartments containing all the apparatus required, such as enclosed bus, meters, overload relays, etc. Provision has been made on panel at extreme right for mounting of flowmeter.

This is only one example of the outstanding installation that is possible with EC&M Steel-clad Motor Control. An illustrated, 16-page Booklet No. 67 gives complete information on typical installations of this control in coal mines, oil refineries, chemical plants and other industrial applications. Write for your copy today.

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TRADE LITERATURE

Air Conditioners—Bulletin No. S-320-1, on gas air conditioners.—The Trane Co., La Crosse, Wis.

Air Ejectors—Folder, on steam jet air ejectors.—Westinghouse Electric & Mfg. Co., East Pittsburgh.

Air Line Fittings—Booklet, on fittings and tools designed to eliminate waste in compressed air lines.—A Schrader's Son, Box 240, General Post Office, Brooklyn, N.Y.

Battery Charger—Catalog Section 27-435, on Rectomatic self-regulating charger.—Westinghouse Electric & Mfg. Co., East Pittsburgh.

Cable Testing—Notebook E-53-441, title "Notes on Fault Location in Cables."—Leeds & Northrup Co., 4934 Stenton Ave., Philadelphia.

Cement—Bulletin N-1, on cold-setting, acid-resistant cement.—Haveg Corp., Newark, Del.

Chairs and Stools—Catalog, on line of industrial stools and chairs.—Royal Metal Mfg. Co., 1138-40 South Michigan Ave., Chicago.

Cleaning Systems—Bulletin No. 63, on industrial vacuum cleaning systems.—Connecticut Blower Co., 183 Ann St., Hartford, Conn.

Coke—Booklet, showing applications of the company's varied products derived from processing coal.—Koppers Co., Pittsburgh.

Combustion Control—Folder, showing line of combustion control instruments.—Hagan Corp., 300 Ross St., Pittsburgh.

Condensers—Bulletin 2149, on radial-flow surface condensers.—Westinghouse Electric & Mfg. Co., East Pittsburgh.

Controllers—Bulletin GEA-1724A, on controllers for synchronous motors.—General Electric Co., Schenectady, N.Y.

Controllers—Bulletin No. 184-2, on Rotax electrically operated controllers.—The Foxboro Co., Foxboro, Mass.

Controllers—Folder No. 89-9, on Air-o-Line air-operated controllers.—The Brown Instrument Co., Wayne & Roberts Aves., Philadelphia.

Controls for Textile Mills—Booklet, on controls for textile mills.—American Schaeffer & Budenberg Instrument Division of Manning, Maxwell & Moore, Inc., Bridgeport, Conn.

Conveyor Chains—Bulletin No. 65, on conveyor chains.—Baldwin-Duckworth Chain Corp., Springfield, Mass.

Conveyors — Bulletin "The Labor Saver", showing installations of Redler conveyors.—Stephens-Adamson Mfg. Co., Aurora, Ill.

Conveyors—Catalog, on roller bearings and selection charts for roller conveyors.—Palmer-Bee Co., Detroit.

Conveyors—Folder 689 on idlers for belt conveyors.—The Jeffrey Mfg. Co., Columbus, Ohio.

Drills—Catalog No. 638, on line of portable electric drills.—Mall Tool Co., 7740 South Chicago Ave., Chicago.

Dust Collector—Folder, on the "Linconditioner," a unit for removing dust and heat from welding operations.—The Lincoln Electric Co., Cleveland.

Electrical Equipment—Booklet, title "List of Inspected Electrical Equipment, May, 1938."—Underwriters' Laboratories, Inc., 207 East Ohio St., Chicago.

Electric Cord—Folder, on Tricord "Rubber Armor" cords and cables.—Triangle Conduit & Cable Co., Inc., Horace Harding & Queens Blvd., Elmhurst, N.Y.

Exhaust Units—Bulletin No. 432, describing slasher exhaust units for textile mill application.—B. F. Sturtevant Co., Hyde Park, Boston, Mass.

Fans—Bulletin X-12, Second edition, title "Standard Methods Adopted for Centrifugal Fans and Blowers."—National Association of Fan Manufacturers, 5-208 General Motors Bldg., Detroit.

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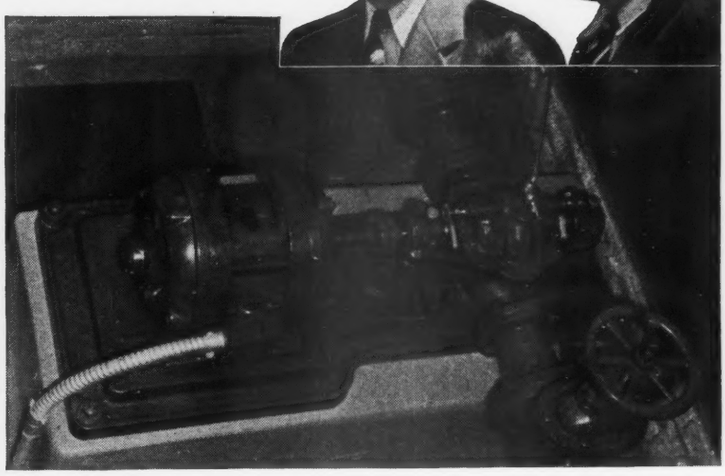

CITY ENGINEER LAURENCE HALE AND GUY EDINGTON, chief engineer of water works, accomplish a 55% cut in pumping costs with three Allis-Chalmers motor-driven centrifugal pumps. Shown above is a 4″ x 3″ SGH pump, rated 400 gpm at 110 ft head. Total maintenance cost for all the pumps—less than $6 a year for lubrication!

The City of Ionia, Michigan, knew that money could be saved by replacing the old pumps in their water works with Allis-Chalmers Centrifugal Pumps. But City Engineer Laurence Hale never expected a saving in pumping costs of 55%!

Actually, that's what happened! In February, 1935, the old pumps consumed 38,903 kwh at a cost of $569.60. But in April, 1935, after the new, modern Allis-Chalmers pumps had been installed, only 14,900 kwh were used . . . and the cost of pumping was only $290.57!

During their first year in operation, the new pumps saved the city of Ionia $2,387.88 in pumping costs. And last year pumping costs were $2,986.35 less than the previous eight-year average!

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The Allis-Chalmers pumps installed at Ionia actually paid for themselves. The cost of pumps and motors, *installed,* was less than $1,500 . . . and they're saving the city of Ionia nearly $3,000 a year! And they'll go on piling up that saving for years to come!

That's a record to shoot at! It's one of the most exciting examples of engineering accomplishment in the Allis-Chalmers files. And Allis-Chalmers is prepared to show you how you can save on pumping costs . . . how municipal and industrial plants can get the benefits of equipment that slashes overhead and operating costs. There's an Allis-Chalmers representative near you. Get in touch with him. Let him show you how to cut costs . . . with the equipment that pays for itself!

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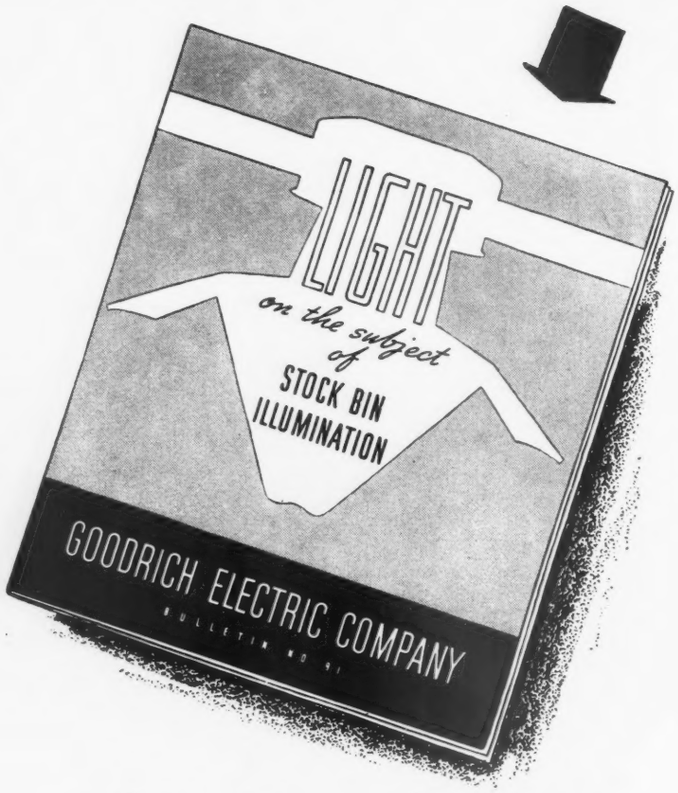

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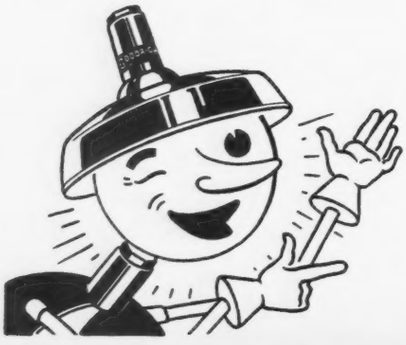

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Furnace Walls—Booklet, on unit-suspended walls for boilers.—Bigelow-Liptak Corp., Detroit.

Gas Masks—Bulletin No. ED-3, on gas masks and different types of canisters for them.—Mine Safety Appliances Co., Braddock, Thomas, and Meade Sts., Pittsburgh.

Glass—Bulletin No. CE-5, on coated cover glass for welders and cutters.—Mine Safety Appliances Co., Braddock, Thomas, and Meade Sts., Pittsburgh.

Goggles—Folder, title "How to Fit Goggles to Workers."—American Optical Co., Southbridge, Mass.

Gray Cast Iron—Section 1, Number 1, of "Nickel Cast Iron Data," a guide to selection of specifications for gray cast iron.—The International Nickel Co., Inc., 67 Wall St., New York.

Hoists and Cranes—Catalog No. 38, several types of hoists and jib cranes.—Ford Chain Block Division of American Chain & Cable Co., Inc., Philadelphia.

Humidifiers—Folder, on humidifiers and float controls.—The Air Conditioning Supply Co., 4060 Superior Ave., Cleveland.

Instruments—Catalog No. 1180, on instruments for breweries, distilleries, and wineries.—C. J. Tagliabus Mfg. Co., Park and Nostrand Aves., Brooklyn, N. Y.

Instruments—Supplement 3 to Catalog 48, on 3-in. square flush mounting panel instruments. — Roller-Smith Co., 233 Broadway, New York.

Insulating Cement—Folder, on No. 1 insulating cement for temperatures up to 1,800 deg. F.—Baldwin-Hill Co., Trenton, N.J.

Insulation—Bulletin No. 1-63, on insulating block.—Refractory & Insulation Corp., 381 Fourth Ave., New York.

Jacks—Folder, on Simplex ball-bearing screw jacks.—Templeton, Kenly & Co., 1020 South Central Ave., Chicago.

Lamps—Leaflet, on Type EVHS explosion-proof hand lamps and Type EVBL explosion-proof, barrel-inspection lamp. Appleton Electric Co., 1701-29 Wellington Ave., Chicago.

Leather Belts—Folder, on Tannate leather belts for textile mills.—J. E. Rhoads & Sons, 35 North Sixth St., Philadelphia.

Lighting Unit—Folder, showing the Correctalite lighting unit.—Holophane Co., Inc., 342 Madison Ave., New York.

Lighting Units—Folder, showing canopy localite lighting units for high-intensity, localized, diffused lighting.—The Fostoria Pressed Steel Corp., Fostoria, Ohio.

Lightning Protection—Booklet No. 396, on Crystal Valve lightning arresters.—Electric Service Supplies Co., 17th and Cambria Sts., Philadelphia.

Machine Tools—Folder, telling of savings made by use of machine tools.—Landis Machine Co., Waynesboro, Pa.

Machining—Bulletin, on Doall band sawing, filing, and polishing machine.—Continental Machine Specialties, Inc., 1301 Washington Ave. South, Minneapolis.

Materials Handling—Book No. 1510, on handling coal and ashes in the power plant.—Link-Belt Co., 300 West Pershing Rd., Chicago.

Materials Handling—Bulletin No. 323, title "How to Handle It If It Is Wood."—Chain Belt Co., Milwaukee.

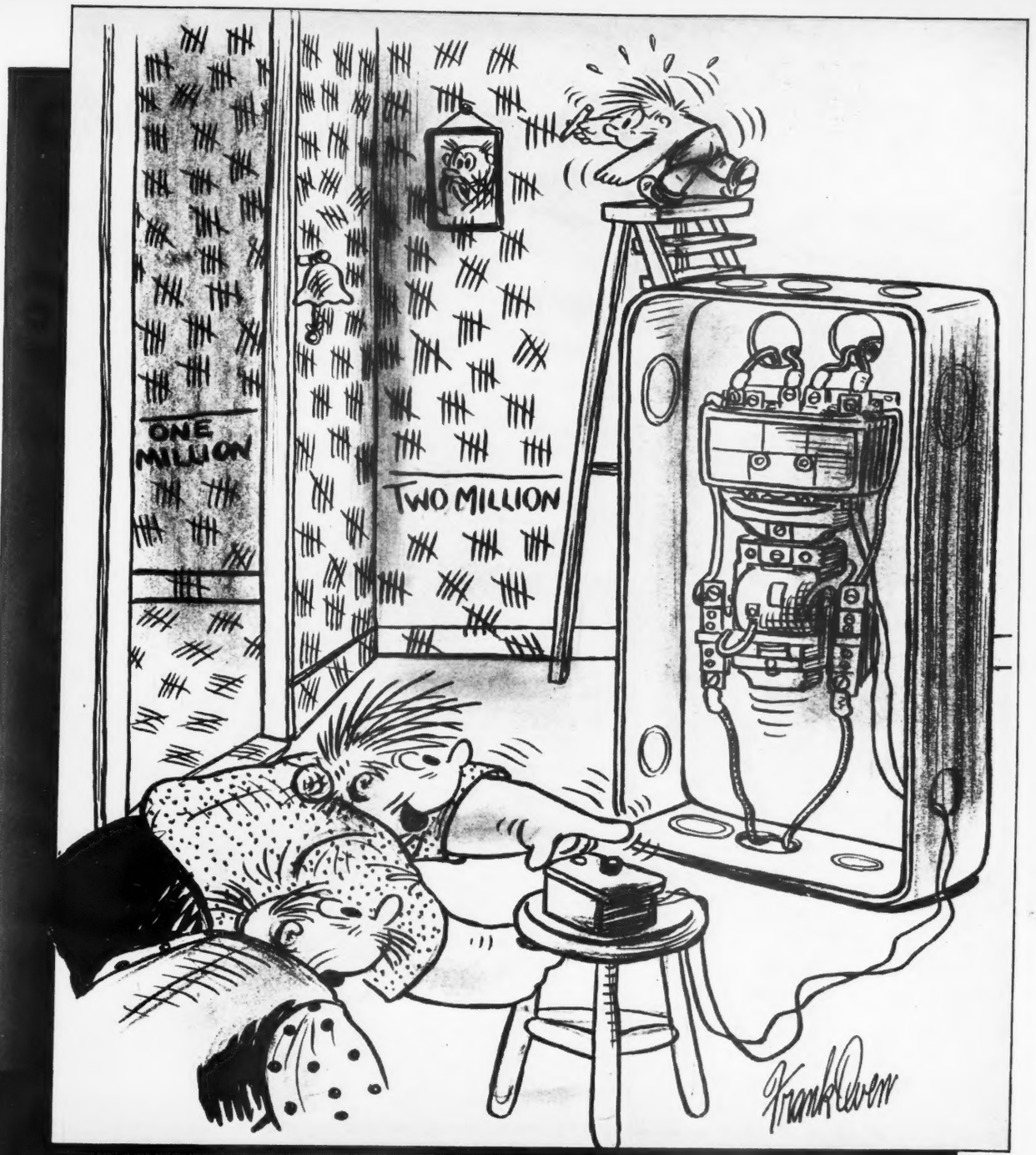
Materials Handling—Folder, on planning of unit loads for overhead materials handling systems.—The Cleveland Crane & Engineering Co., Wickliffe, Ohio.

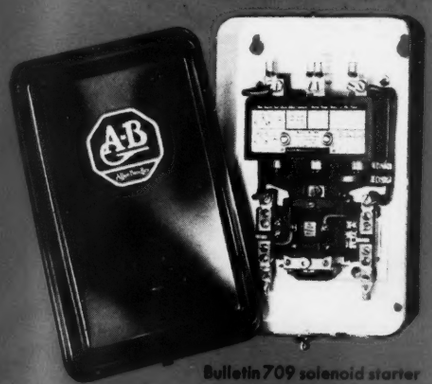
Mechanical Power Transmission—Bulletin No. 307, announcing new models of Graham variable-speed transmissions.—Graham Transmissions, Inc., 2711 North 13th St., Milwaukee.

Mechanical Power Transmission—Catalog No. 68, on JFS Variable Reducer Transmission.—Stephens-Adamson Mfg. Co., Aurora, Ill.

Mechanical Power Transmission—Leaflet, announcing "Speedial" handwheel for variable-speed-control equipment.—Reeves Pulley Co., Columbus, Ind.

(*Continued on page* 134)





Bulletin 709 solenoid starter for squirrel-cage motors.

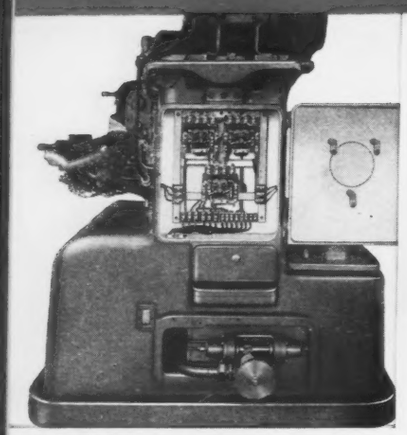
"He wants to know when this starter will wear out!"

Here is a starter that has been made as simple as possible. Bearings, pivots, and flexible jumpers have been eliminated. The double break, silver alloy contacts never need to be cleaned or filed. They are always in first-class operating condition.

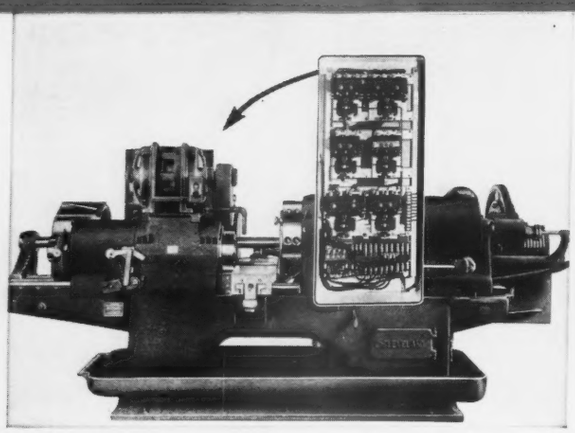
Allen-Bradley solenoid starters will easily interrupt currents of not less than ten times their maximum horsepower rating. Millions of operations have been built in. Prove these facts to yourself by using Allen-Bradley standard starters on your toughest jobs.

ALLEN-BRADLEY SOLENOID MOTOR CONTROL

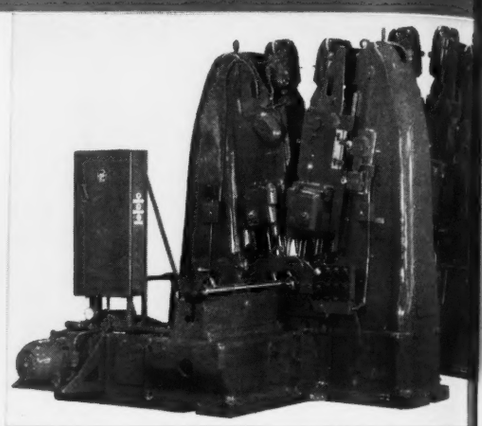
These Machine Builders get TROUBLE-FREE CONTROL with Standard A-B Solenoid Starters



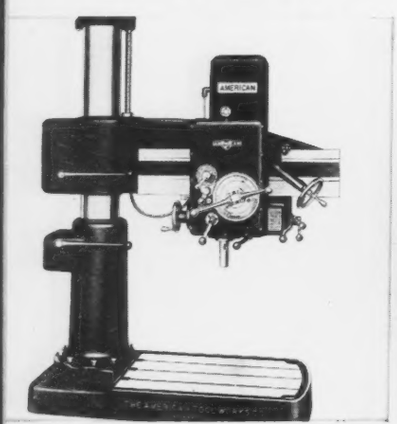
PRATT & WHITNEY hydraulic gear grinder with special control panel of three Bulletin 709 solenoid starters.



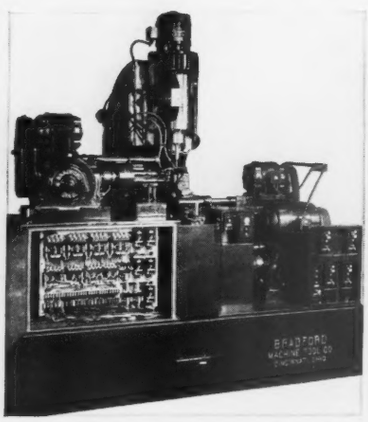
CLEVELAND AUTOMATIC MACHINE CO. single spindle turret lathe equipped with an Allen-Bradley control panel that synchronizes machine operations. Control panel is shown in the inset.



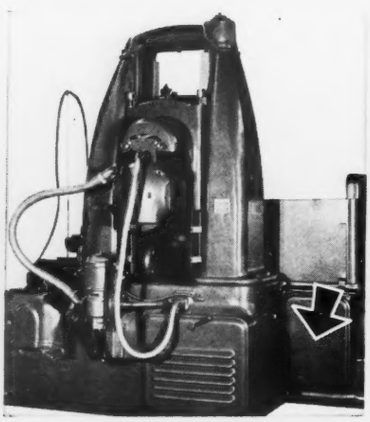
FOOTE-BURT 24-spindle automatic drilling machine controlled by special panel at left, made up of Allen-Bradley solenoid relays, contactors, and motor starters.



THE AMERICAN TOOL WORKS CO. "Hole Wizard" radial equipped with built-in reversing switch and solenoid starter.



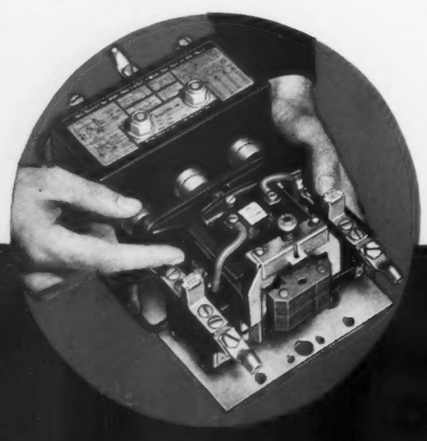
BRADFORD MACHINE TOOL CO. drilling and tapping machine with complicated control panel neatly built into base.



MATTISON MACHINE WORKS surface grinder with built-in control panel. Machined cover makes enclosure dust-tight.

CROSS GEAR & MACHINE CO. gear tooth rounder with control built into dust-tight enclosure.

Bulletin 709 across-the-line starter for squirrel-cage motors.



● Machine tool operations today have become exceedingly complex. Automatic sequence operations have replaced manual control in many places. Motor starters for these machines must give millions of trouble-free operations.

To provide this trouble-free performance the Allen-Bradley solenoid starter was made with the minimum of moving parts. All trouble-making pivots, pins, bearings, hinges, flexible jumpers, and complicated mechanisms were eliminated. That's why so many prominent machine builders specify Allen-Bradley control.

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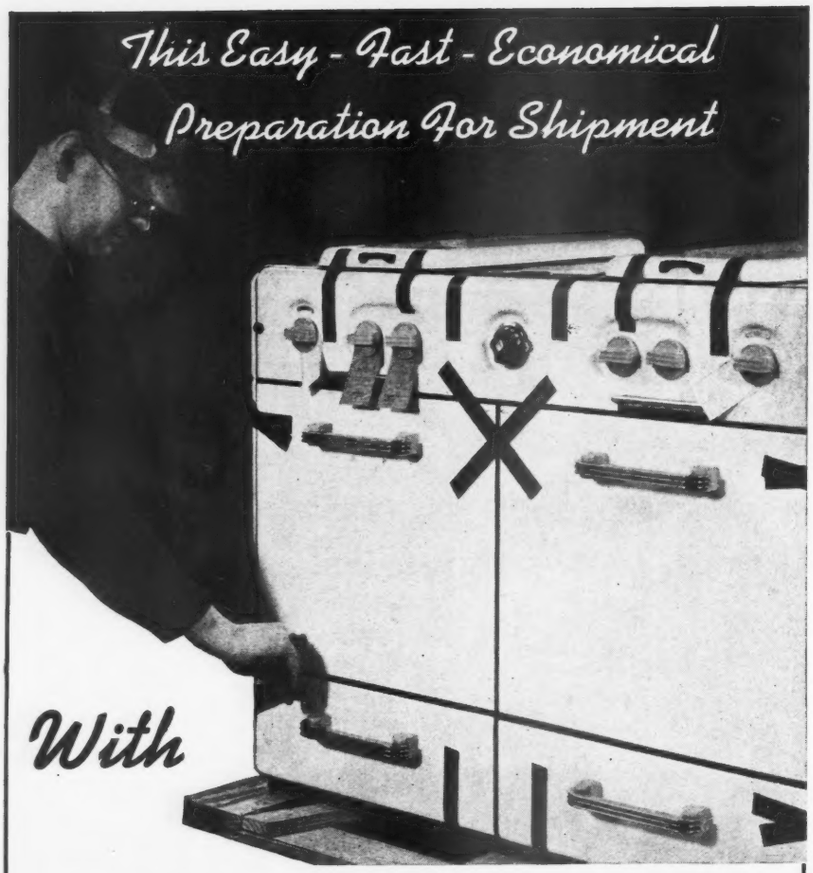

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(Continued from page 130)

Mechanical Rubber Goods—Catalog, on mechanical rubber goods products, containing hints on care of rubber belting.—The Goodyear Tire & Rubber Co., Akron, Ohio.

Motors—Bulletin M-2, on convertible slip-ring motors.—Harnischfeger Corp., Milwaukee.

Motors—Bulletin No. 1022, describing more than 60 types of small motors equipped with speed reducers.—Bodine Electric Co., 2264 West Ohio St., Chicago.

Nickel—Reprint of an article titled "Nickel — A Versatile Automotive Metal."—The International Nickel Co., Inc., 67 Wall St., New York.

Occupational Diseases—Pamphlet, title "Medicolegal Trends: Occupational Diseases."—Dr. C. O. Sappington, 330 South Wells St., Chicago.

Oil Filters—Three leaflets, on fuel and lube oil filters for diesel engines.—Wm. W. Nugent & Co., Inc., 417 North Hermitage Ave., Chicago.

Pipe Hangers—Chart, showing line of adjustable pipe hangers and supports.—Grinnell Co., Inc., 260 West Exchange St., Providence, R. I.

Piston Ring—Leaflet, showing Pedrick "Seal Cut" piston ring.—Wilkening Mfg. Co., Philadelphia.

Protective Coating—Booklet, on Amercoat sprayable plastic coating for concrete, metal, and wood.—American Concrete Steel Pipe Co., P. O. Box 1428, Arcade Station, Los Angeles.

Pumps—Catalog No. 38-P, on line of high-vacuum pumps.—F. J. Stokes Machine Co., Olney P. O., Philadelphia.

Puzzuolanic Material — Booklet, on Pozzolith, a plasticizer for concrete.—The Master Builders Co., 7016 Euclid Ave., Cleveland.

Railway Cars—Bulletin 71, on Industrial railway cars.—Pressed Steel Car Co., Inc., Koppel Division, Pittsburgh.

Recorders—Bulletin No. 510, on machine-operation recorders.—The Bristol Co., Waterbury, Conn.

Refractory Products—Form DS Series 700, on line of refractory products, including cements, castables, and plastics.—Johns-Mansville, 22 East 40th St., New York.

Rolling Grills—Bulletin No. 21, on "Rolling Grilles."—The Kinnear Mfg. Co., 2450-70 Fields Ave., Columbus, Ohio.

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Sawing Machine—Bulletin VM-1, on machines for contour machining.—Continental Machine Specialties, Inc., 1303 South Washington Ave., Minneapolis.

Scales—Bulletin 385, on automatic batching scales.—Buffalo Scale Co., Buffalo, N. Y.

Silicosis—Reprint No. 38-35, title "Silicosis in the Foundry Industry."—American Foundrymen's Association, Inc., 222 West Adams St., Chicago.

Standardization—Booklet, "American Standards Year Book, 1938."—American Standards Association, 29 West 39th St., New York.

Steel—Booklet, on Stressproof steel.—La Salle Steel Co., Palmolive Bldg., Chicago.

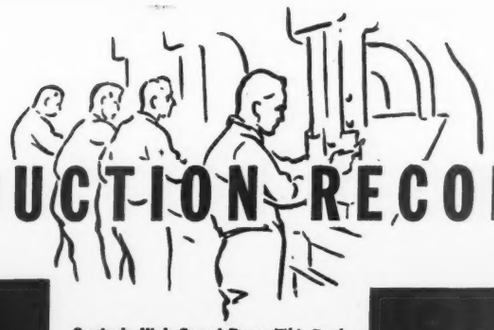
Steel—Booklet, title "Cutting Costs With Cold Drawn Steel."—Union Drawn Steel Division, Republic Steel Corp., Massillon, Ohio.

Steels—Booklet, on stainless steels.—The American Rolling Mill Co., Middletown, Ohio.

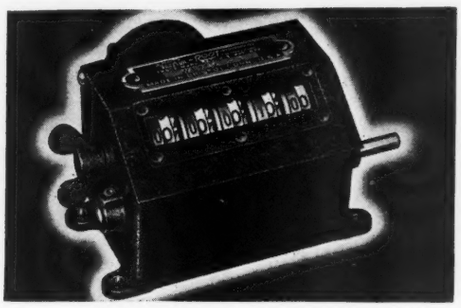
Switches—Catalog No. 9, on Type R-2 rotary instrument and control switches.—Roller-Smith Co., 233 Broadway, New York.

Switches—Folder, describing Type RBA heavy-duty inclosed switches.—The Trumbull Electric Mfg. Co., Plainville, Conn.

Tachometer — Bulletin 1575, on "Jagabi" Type A universal hand tachometer.—James G. Biddle Co., 1211-13 Arch St., Philadelphia.



PRODUCTION RECORDS



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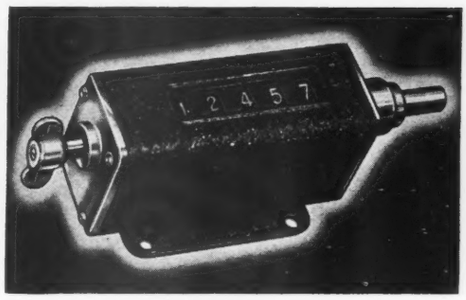
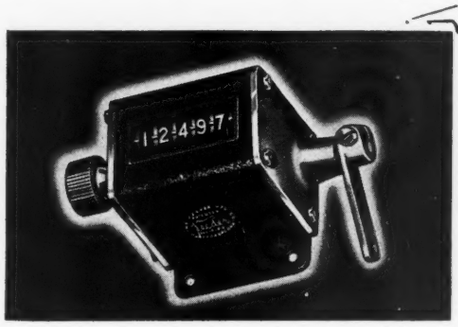


OFFICE RECORDS



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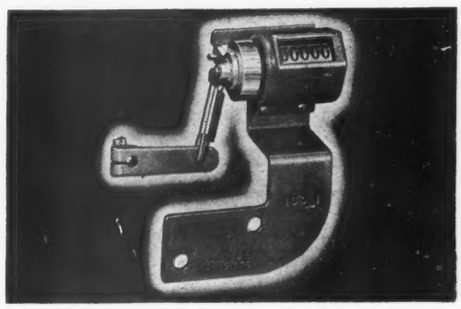

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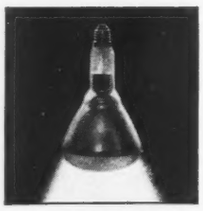

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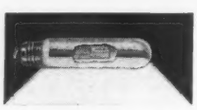

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Truck Casters—Catalog No. 53, on truck casters and wheels.—The Fairbanks Co., 401 Lafayette St., New York.

Trucks—Bulletin No. A-8330, describing Type E-1 high-lift platform trucks.—Elwell-Parker Electric Co., Cleveland.

Trucks—Catalog No. 52, on platform and special trucks.—The Fairbanks Co., 401 Lafayette St., New York.

Turbines—Booklet B-2084-A, describing Type C steam turbines.—Westinghouse Electric & Mfg. Co., East Pittsburgh.

Turbines—Bulletin 2137, on Type C steam turbines of 5 to 500 hp.—Westinghouse Electric & Mfg. Co., East Pittsburgh.

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Welder Controls — Bulletin GEA-2791A, on Thyratron resistance-welder controls.—General Electric Co., Schenectady, N. Y.

Welding — Booklet 18C, describing Thermit welding and its applications.—Metal & Thermit Corp., 120 Broadway, New York.

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Welding Electrodes — Pamphlet, on Murex welding electrodes.—Metal & Thermit Corp., 120 Broadway, New York.

Welding Electrodes—Two bulletins: GEA-2966 on Type A sheath-coated electrode for cast iron welding, GEA-2965 on Type W-3 thinly coated electrode for high-speed arc welding.—General Electric Co., Schenectady, N.Y.

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Valves—Bulletin B on packless gate and globe valves.—Monat Valve & Forge Co., Inc., Bessemer Bldg., Pittsburgh.

Valves—Reference Book No. 38, on line of valves of different types.—Homestead Valve Mfg. Co., Coraopolis, Pa.

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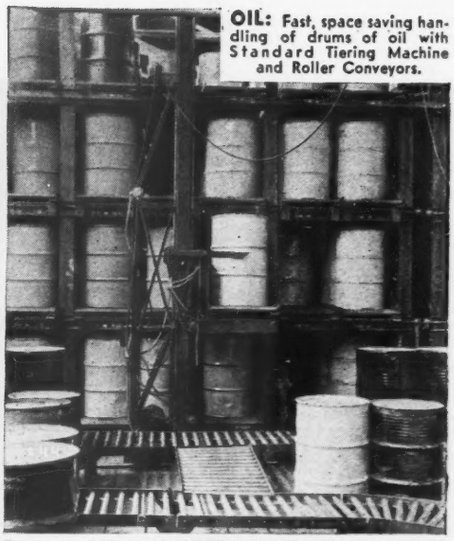

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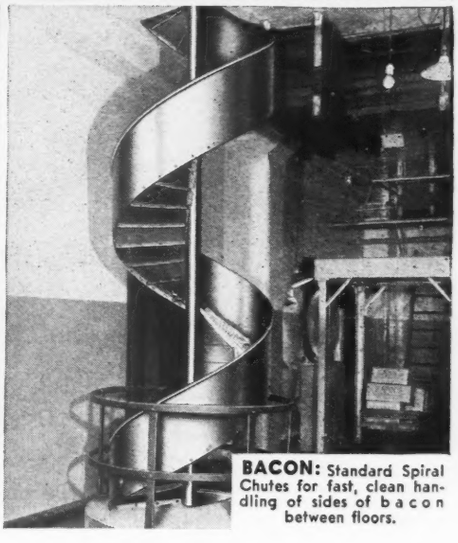

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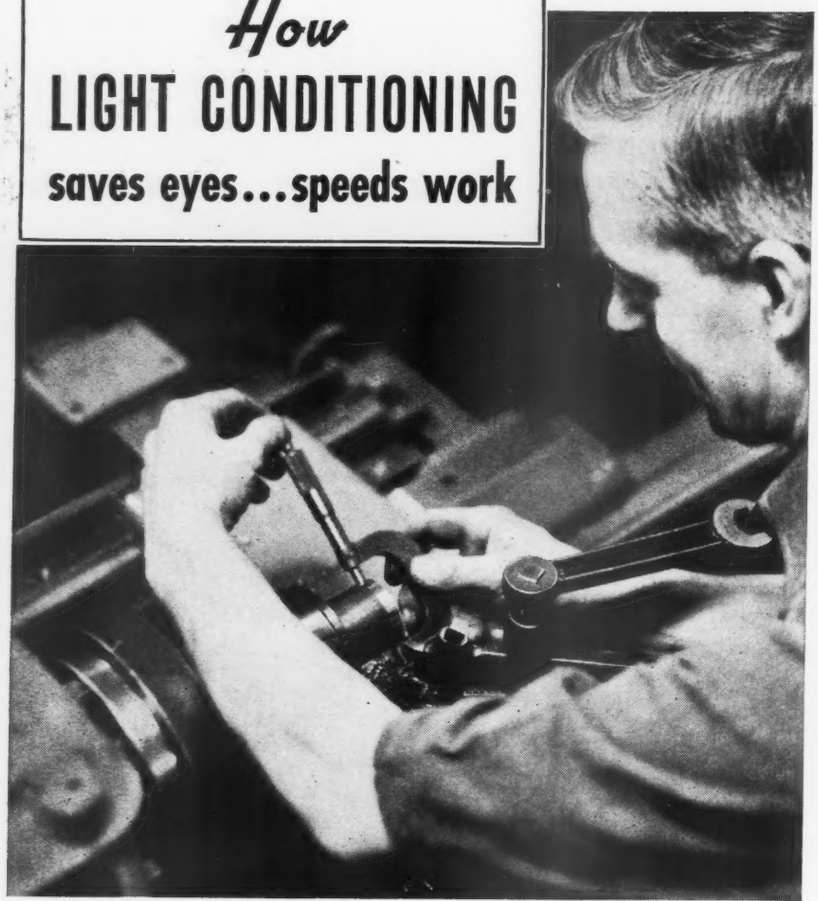

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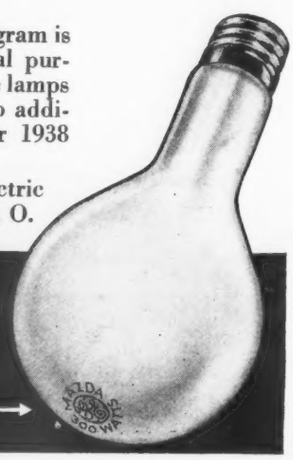

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New York. 665 pages, tables, charts, maps, index. $4.

The new American system of unemployment service and compensation is considered from the administrative viewpoint. Analysis is made of the federal-state system and of five state and jurisdictional plans; namely, Wisconsin, New York, New Hampshire, California, and the District of Columbia. Progress in both spheres is surveyed and defects pointed out. Most important of the conclusions drawn is that differences among the various state systems will make a national system inevitable.

INDUSTRIAL PRICE POLICIES AND ECONOMIC PROGRESS

Edwin G. Nourse and Horace B. Drury. The Brookings Institution, Washington, D. C. 314 pages, index. $2.50.

Recognizing that prices are established largely on the basis of what executives think they must be in order to yield adequate profits, this study undertakes to get down to cases and review price policies and their results, with the view to determining whether or not prices are often set too high. Factors complicating the price maker's decision are considered, and an attempt is made to answer the question: Can business men reduce prices and maintain profits?

INCENTIVES AND CONTENTMENT

Patricia Hall and H. W. Locke. Sir Isaac Pitman & Sons, Ltd., Parker St., Kingsway, W. C. 2, London, or 2 West 45th St., New York. 190 pages, index. One dollar.

This book is the result of a study made in a British factory to determine what incentives employees respond to, and what incentives lead to greatest contentment. Nature and methods of the inquiry are outlined, and the findings have been classified. Conclusions point out several needs: Cordial cooperation between employees and management, machinery for handling grievances, ways for dealing with employees suffering from psychological maladjustment, careful selection of leaders.

•

ON THE CALENDAR

SEPTEMBER

8–9, Conference on Engineering and Industrial Statistics, Massachusetts Institute of Technology, Cambridge, Mass. Address correspondence to Secretary, Conference on Engineering and Industrial Statistics, Massachusetts Institute of Technology, Cambridge, Mass.

13–16, Convention of National Small Business Men's Association, Syria Mosque Temple, Pittsburgh. Margaret Robson, Secretary, 163 North Union St., Akron, Ohio.

19–23, Seventh International Management Congress, Washington, D. C., N. W. Barnes, Executive Secretary, 347 Madison Ave., New York.

22–24, American Trade Association Executives, Annual Meeting, Pittsburgh. Herman Fakler, Chairman, 726 Jackson Place, Washington, D. C.

21–23, National Industrial Advertisers Association, Inc., 1938 Conference, Cleveland. Miss Mildred R. Webster, Headquarters Secretary, 100 East Ohio St., Chicago.

OCTOBER

5–7, American Society of Mechanical Engineers, Fall Meeting, Providence, R. I. C. E. Davies, Secretary, 29 West 39th St., New York.

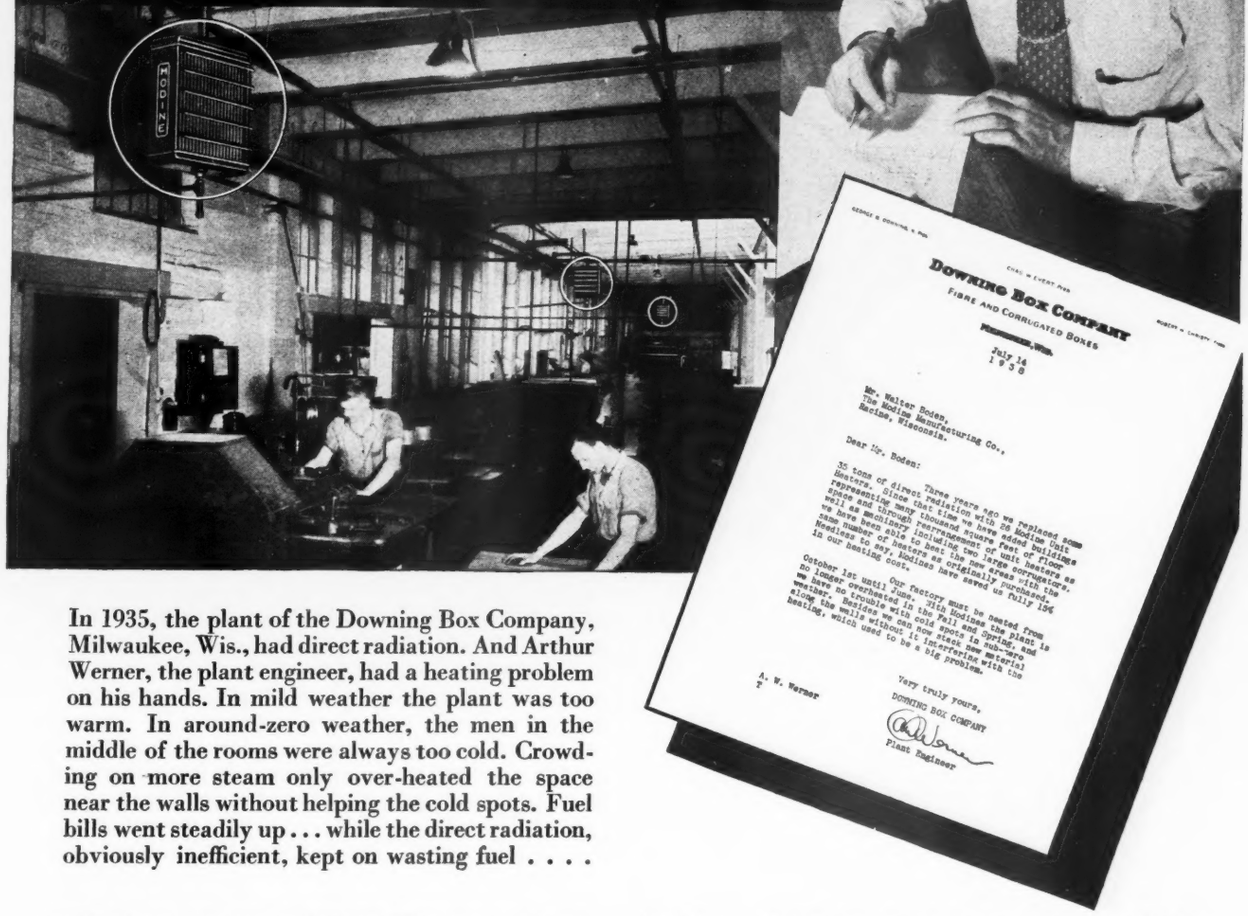
10–14, National Safety Council, Annual Meeting, Chicago. W. H. Cameron, Secretary and Managing Director, 20 North Wacker Drive, Chicago.

24–28, National Electrical Manufacturers Association, Annual Meeting, Chicago. W. J. Donald, Managing Director, 155 West 44th St., New York.

This Plant Engineer says...

MODINE UNIT HEATERS

"Saved 15% in Heating Costs"



DOWNING BOX COMPANY
FIBRE AND CORRUGATED BOXES

July 14
1938

Mr. Walter Boden,
The Modine Manufacturing Co.,
Racine, Wisconsin.

Dear Mr. Boden:

Three years ago we replaced some 35 tons of direct radiation with 26 Modine Unit Heaters. Since installation we have added Modines as we have enlarged our plant. Now, with two of our heaters as emergency reserve, we have 28 Modines heating 156,000 square feet of floor space and the equipment has paid for itself in fuel savings.

Our factory must be heated from October 1st until June. With Modines the plant is no longer overheated in the Spring, and we have no overheated air to waste through the roof. Nor do we suffer from cold spots and drafts in sub-zero weather. The walls are cool, even though the temperature within is comfortable. Modines have saved us fully 15% in our heating cost.

Very truly yours,
DOWNING BOX COMPANY
Plant Engineer

A. W. Werner
2

In 1935, the plant of the Downing Box Company, Milwaukee, Wis., had direct radiation. And Arthur Werner, the plant engineer, had a heating problem on his hands. In mild weather the plant was too warm. In around-zero weather, the men in the middle of the rooms were always too cold. Crowding on more steam only over-heated the space near the walls without helping the cold spots. Fuel bills went steadily up . . . while the direct radiation, obviously inefficient, kept on wasting fuel . . . .

. . . and plant engineer Arthur Werner realized how vitally factory heating affects production and profits.

With obsolete, wasteful direct radiation, sub-zero weather meant not only high coal bills—but shut-downs in parts of the plant, decreased output by the men, time lost due to illness . . .

. . . so Mr. Werner replaced 35 tons of direct radiation with 26 Modine Unit Heaters—and *"saved fully 15% in heating costs"*—thereby lowering factory production costs.

Modines distribute heat more evenly and thoroughly . . . deliver it *downward* direct to floors and working zones where needed. Modines heat faster. On coldest mornings there's no waiting for warm-up with Modine Unit Heaters. Turn on the Modines, heat is delivered immediately. No fuel is wasted . . . off goes the switch, heat delivery stops.

In offices, warehouses, factories, Modines are cutting fuel costs 13½ to 25% *and more.* Write today for catalog.

MODINE MANUFACTURING COMPANY, 1730 Racine Street, RACINE, WISCONSIN

HEATING, COOLING and AIR CONDITIONING EQUIPMENT for INDUSTRIAL, COMMERCIAL and RESIDENTIAL APPLICATION

COVER YOUR NEW PLANT OR ADDITION

WITH Wheeling CORRUGATING COMPANY Tri-Rib STEEL ROOF DECK

Purlin clip to attach the roof deck to the beam, channel or joist purlin as shown above.

Intermediate clip used between supports to tie the sides of the Tri-Rib roof deck plates together.

It Is Quickly Clipped or Welded to the Purlins

● Wheeling Tri-Rib Steel Roof Decks are made of 18, 20 or 22 gauge COP-R-LOY sheets 18″ wide reinforced with three ribs spaced 6″ on centers. They speed up roof construction because they minimize the number of parts to be handled and can be quickly attached to the purlins by welding or by the use of clips. All erection work is from the top of the deck. The individual units lap at the ends for rigid construction and an even surface. As soon as the roof deck is laid, roofers can proceed immediately with the application of insulation and roofing. Ask about this modern roof deck today!

NEW YORK
CHICAGO
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WHEELING CORRUGATING CO.
WHEELING, WEST VIRGINIA

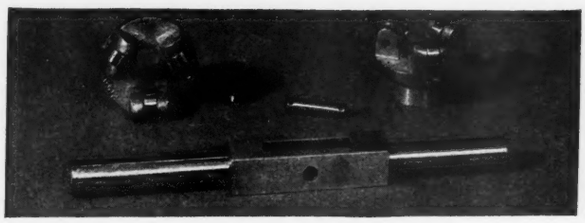
KANSAS CITY
ATLANTA
COLUMBUS, O.
MINNEAPOLIS
RICHMOND
DETROIT

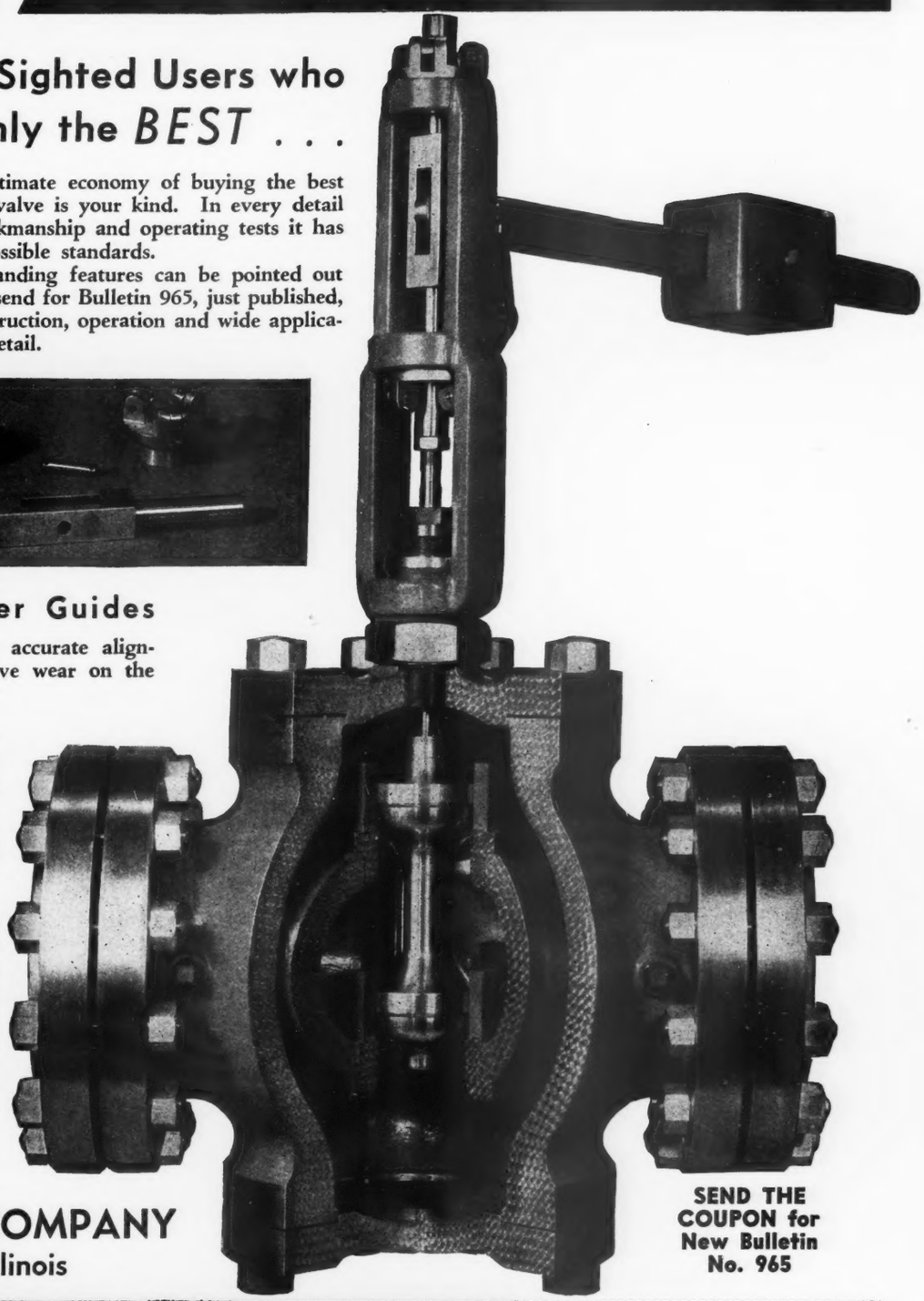
SERIES 42 BALANCED LEVER VALVE

Built for Far-Sighted Users who will install only the *BEST* . . .

If you believe in the ultimate economy of buying the best . . . this new Series 42 valve is your kind. In every detail of design, materials, workmanship and operating tests it has been made to highest possible standards.

Only a few of its outstanding features can be pointed out here. We invite you to send for Bulletin 965, just published, which describes the construction, operation and wide application of these valves in detail.





Exclusive Roller Guides

Hold the valve stem in accurate alignment, eliminating excessive wear on the packing, so that it stays tight—lasts longer.

Precision-made in every detail — there's no lost motion and regulation is extremely accurate.

Made of best materials, all parts heavy and strong. Very thick, uniform walls.

They'll handle almost all fluids and pressures, and are good for innumerable uses. Easily operated by floats, solenoids, pistons, cables and many other devices. For extremely close automatic control, CASH STANDARD Series 90 and 100 controllers are recommended.

A. W. CASH COMPANY
Decatur, Illinois

SEND THE COUPON for New Bulletin No. 965

CASH STANDARD
CONTROLS . . VALVES

USE THIS COUPON

A. W. CASH COMPANY
P.O. Box 135, Decatur, Illinois

Kindly mail me Bulletin 965 covering the new series 42 balanced lever value.

Name .....

Company .....

Address .....

(Fac.)

Where RUST rides the roads HOT-DIP GALVANIZING is needed

With the development of our elaborate highway systems, come heavy repair and maintenance costs. Steel must replace weaker materials and hot dip galvanizing must close these roads to rust . . . In concrete armoring, safety guards, poles, posts, railings, curb bars, culverts and light hardware, hot dip galvanized steel unquestionably serves more efficiently and at less cost . . . Patronize members of this association and know that you are getting a quality hot dip job handled by expert personnel in a modernly equipped plant . . . American Hot Dip Galvanizers Association, Inc., American Bank Building, Pittsburgh, Pa.

IF IT CARRIES THIS SEAL IT'S A JOB WELL DONE

Acme Galvanizing, Inc., Milwaukee, Wis.
Acme Steel & Malleable Iron Works, Buffalo, N. Y.
American Tinning & Galvanizing Co., Erie, Pa.
Atlantic Stamping Co., Rochester, N. Y.
Buffalo Galvanizing & Tinning Wks., Inc., Buffalo, N.Y.
Columbian Steel Tank Company, Kansas City, Mo.
Diamond Expansion Bolt Co., Inc., Garwood, N. J.
Enterprise Galvanizing Co., Philadelphia, Pa.
The Fanner Mfg. Company, Cleveland, Ohio
John Finn Metal Works, San Francisco, Cal.
Thomas Gregory Galvanizing Works, Maspeth, N. Y.
Hanlon-Gregory Galvanizing Co., Pittsburgh, Pa.
The Hodell Chain Company, Cleveland, Ohio
Independent Galvanizing Co., Newark, N. J.
International Derrick & Equipment Co., Columbus, Ohio
Joslyn Co. of California, Los Angeles, Cal.
Joslyn Mfg. & Supply Co., Chicago, Ill.
L. O. Koven & Brother, Inc., Jersey City, N. J.
Lehigh Structural Steel Co., Allentown, Pa.
Missouri Rolling Mill Corp., St. Louis, Mo.
The National Telephone Supply Co., Cleveland, Ohio
Penn Galvanizing Co., Philadelphia, Pa.
Riverside Foundry & Galvanizing Co., Kalamazoo, Mich.
San Francisco Galvanizing Works, San Francisco, Cal.
The Sanitary Tinning Co., Cleveland, Ohio
Standard Galvanizing Co., Chicago, Ill.
Wilcox, Crittenden & Co., Inc., Middletown, Conn.
The Witt Cornice Co., Cincinnati, Ohio

Why it pays to have

Rhoads TANNATE Leather Belting

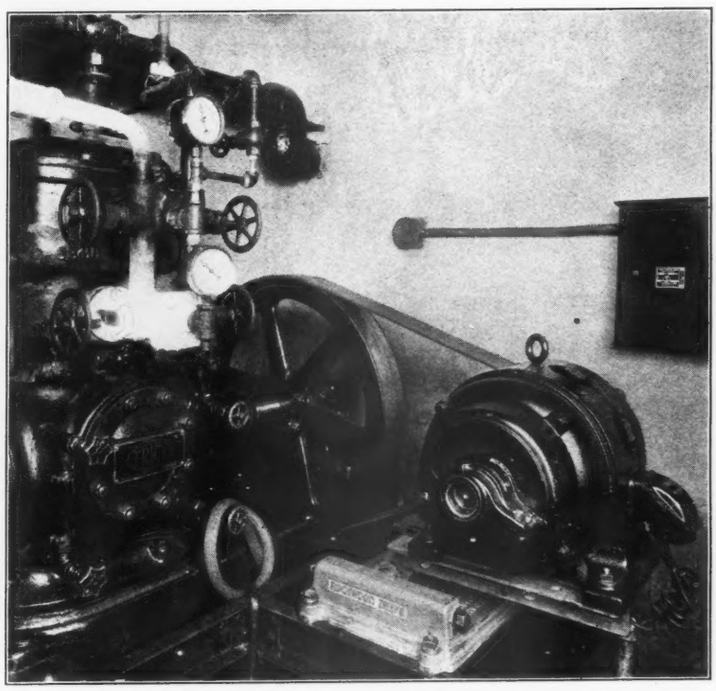
on the job throughout your plant!

TODAY, more than ever, your mechanical equipment must be dependable, efficient and long lasting—your profits depend on it. Your costs per unit of production must be kept down.

That's why it pays to buy Rhoads TANNATE Leather Belting for the drives in your plant. Made by the exclusive Rhoads TANNATE Process, they give you more and steadier power, less slippage and longer wear—more of these qualities than you've been able to get from any other make of belt.

True, they cost a little more, as far as first cost is concerned—but you will find, as have hundreds of others, that their greater strength, suppleness and gripping power, plus their exceptionally long life, pay you handsome dividends in the long run. Our files are full of the experiences of pleased users who have learned from their use of TANNATE the extra profits this truly remarkable belting makes possible. Yes, it pays to turn to TANNATE.

Send us your order TODAY for TANNATE Belts—we back them to the limit with the Rhoads Service Guarantee. And they'll save you money!



Compared with V-Belts, the TANNATE-Rockwood Drive is proving to be the most efficient solution of short-center drive problems.

RHOADS TANNATE

5 RHOADS TANNATE ECONOMY FACTORS To Increase Your Profits Per Unit of Production

1 **GREATER PRODUCTION** . . . —through *maximum power transmission capacity* even under heavy load.

2 **HIGHER QUALITY OF OUTPUT** —through *steady flow of power* under varying condition of load.

3 **LOWER REPLACEMENT COSTS** —through *longer service-life.*

4 **LOWER MAINTENANCE COSTS** —through *greater resistance to wear.*

5 **ASSURANCE OF SATISFACTION** —through *Rhoads Service Guarantee.*

J. E. RHOADS & SONS
Established 1702

Philadelphia, 35 N. Sixth Street

New York Chicago Atlanta Cleveland

Factory and Tannery, Wilmington, Delaware

TANNATE LEATHER BELTING

LOWERS COSTS Per Unit of Production

YOU DEMAND BEAUTY OF FINISH PLUS PRESERVATION. YOU GET BOTH WITH LIGNOPHOL.
ILLUSTRATION SHOWS HOW DEEPLY LIGNOPHOL PENETRATES THE WOOD

Wood floors will have a lasting finish *Plus* permanent preservation with *Lignophol*

Wood deteriorates when subjected to the harmful effects of traffic, moisture and bacteria and soon loses its resilient and resistive powers unless properly protected.

LIGNOPHOL fills the cells of the wood with toughening resins to help the wood take abuse; with penetrating oils to keep out moisture and with skillfully selected preservatives to prevent the entrance and growth of bacteria molds and wood destroyers.

The ordinary treatment of paint, shellac or varnish gives only a surface coating that is readily broken or marred and is therefore not suitable for factory floors.

LIGNOPHOL *will give a durable, attractive finish and at the same time protect against:*

WARPING • WET AND DRY ROT
CRACKING, SPLINTERING, PITTING
WOOD FLOORS • TRACKED-IN MUD
AND WATER • MARKING AND
BURNING FROM RUBBER SHOES

See the center panel for a few more of the many reasons — why you will want to specify LIGNOPHOL, the natural wood preservative and finish.

Write Dept. FM9 today for proof of LIGNOPHOL'S performances "on the job." Full information regarding local installations will be gladly furnished upon request.

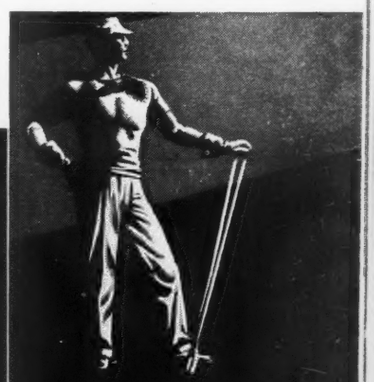
L. SONNEBORN SONS, INC. 88 Lexington Ave., New York City

No maintenance worries when SAFE, dependable J&L SEAMLESS goes into your *Power Piping* job

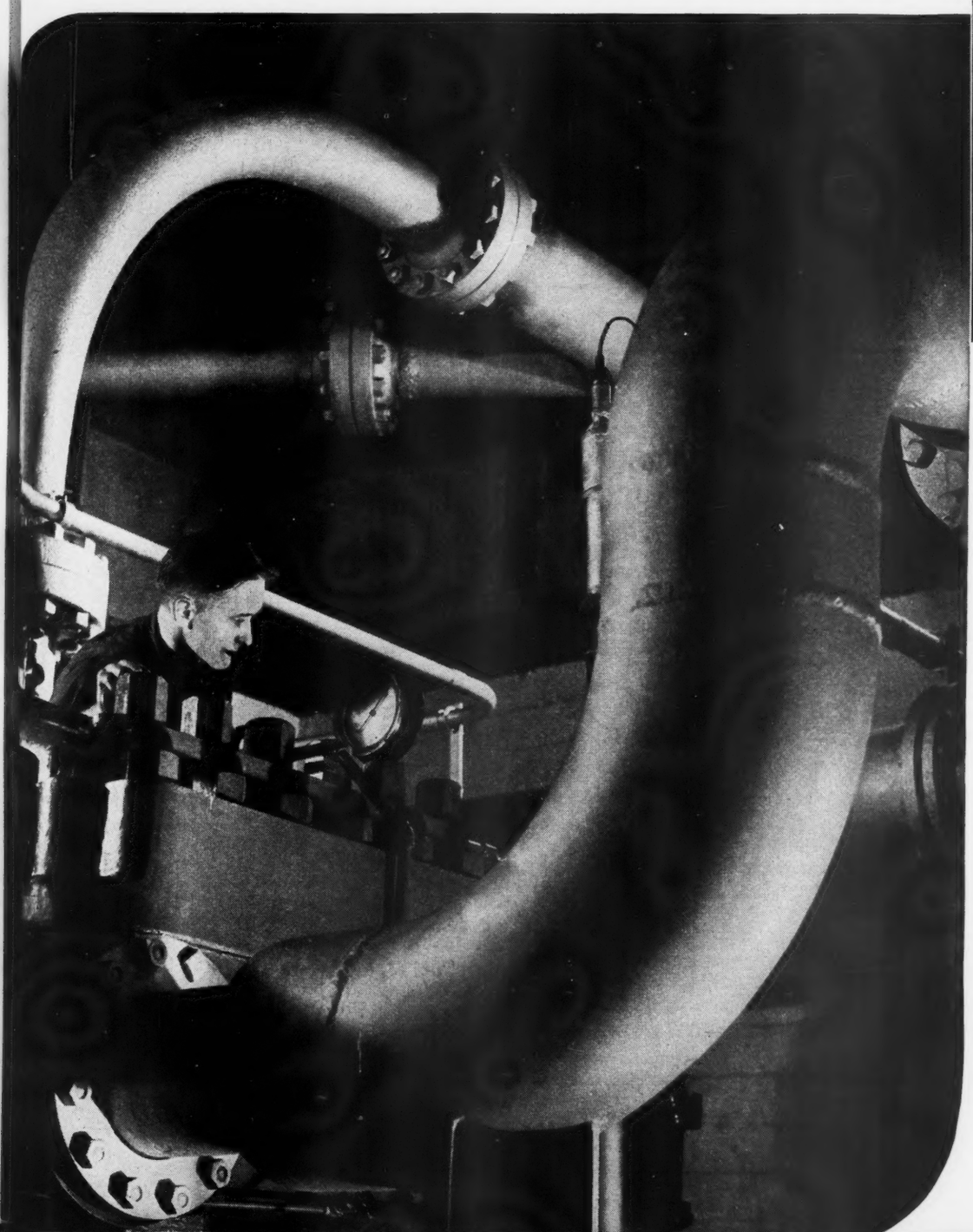
Power plant engineers and maintenance men all over the country have long looked with favor on J & L Seamless Pipe, for they know its reputation for dependable service, safety and strength. Hundreds of successful installations in factories, power and processing plants prove the remarkable operating efficiency and the excellent workability of this high quality pipe.

Each length of J & L Seamless is manufactured from a solid billet of specially selected steel, uniformly heated to correct rolling temperature. The high quality of the steel and the J & L Seamless process assure the right amount of ductility for easy bending, coiling and upsetting—plus the strength and ruggedness that give long life and extra safety.

You can depend upon J & L Seamless to carry the load. There are no weaknesses to invite trouble or cause plant shut-downs. Specify J & L Seamless Pipe for all future power and process requirements — and for replacement jobs as well. You'll find that J & L Seamless stands up under the most severe treatment, gives years of trouble-free service and saves money in lower maintenance costs.



J & L—ALWAYS MAKING FINER CARBON STEEL PRODUCTS FOR NEW AND BETTER USES



J&L PIPE

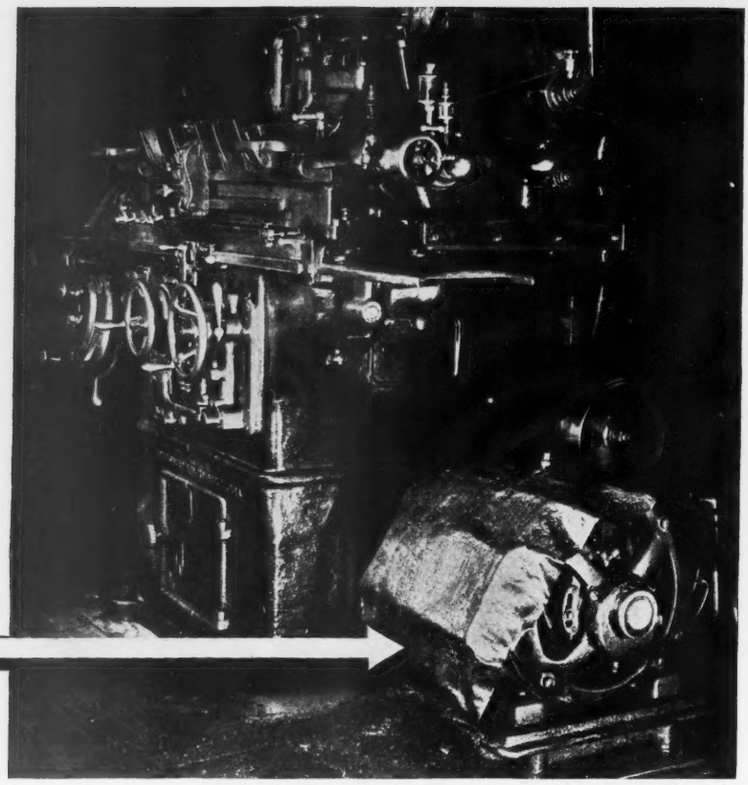
JONES & LAUGHLIN STEEL CORPORATION

AMERICAN IRON AND STEEL WORKS
PITTSBURGH, PENNSYLVANIA

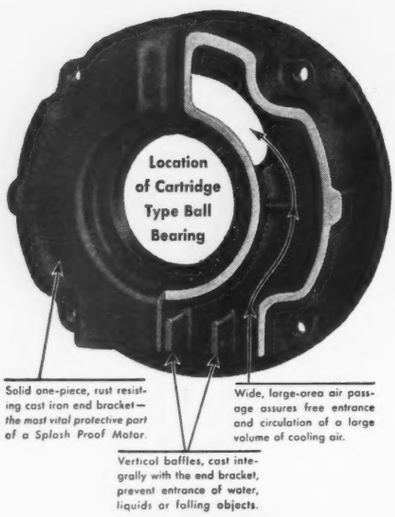
MAKERS OF HIGH QUALITY IRON AND STEEL PRODUCTS SINCE 1850

Guard Against Damage and Loss
Don't Use Makeshift Motor Protection

Put this CENTURY SPLASH PROOF MOTOR *HERE*



Illustrating Flimsy, Doubtful Protection. This shows how NOT to do it.


Location of Cartridge Type Ball Bearing
Solid one-piece, rust resisting cast iron end bracket—the most vital protective part of a Splash Proof Motor.
Wide, large-area air passage assures free entrance and circulation of a large volume of cooling air.
Vertical baffles, cast integrally with the end bracket, prevent entrance of water, liquids or falling objects.

GET LASTING MOTOR PROTECTION against damage from falling chips, solids and splashing liquids that so often endanger the vital internal parts of a motor, when it is mounted at or near the floor level.

At only a small extra cost a Century Splash Proof Motor assures longer motor life—more continuous production—lower maintenance and greater safety—because the solid one-piece frame and heavy cast-iron end brackets enclose and permanently protect the motor.

Users throughout industry have found that this protective construction is definite assurance against costly damage and losses that often result when makeshift, "dog house" enclosures or thin, flimsy coverings are used.

Look at the end bracket section—see how it is designed to keep water out and pass air through.

Then let Century show you where and how Splash Proof Motors save money by giving you lasting protection at little extra cost.

CENTURY ELECTRIC COMPANY

1806 Pine Street • • • St. Louis, Mo.

Offices and Stock Points in Principal Cities

Century MOTORS

ONE OF THE LARGEST EXCLUSIVE MOTOR MANUFACTURERS IN THE WORLD

"Grip-tread" Floors around dangerous machinery

INDUSTRIAL ACCIDENTS cost money. They impair morale, reduce workers' efficiency.

That's why it's so important to have "Grip-tread" *Mastipave* on the floors of all areas around high-speed machinery. It gives a sure, safe under-footing that steadies workers' nerves; allows them to keep their minds on their work instead of on the dangers surrounding their jobs.

"Grip-tread" *Mastipave* is the ideal industrial floor covering from many other angles, in addition to the safety feature. It's water-proof, rot-proof, vermin-proof . . . self-healing, if cut or scratched . . . tough, yet resilient underfoot...impervious to most acids and other chemicals . . . unbelievably wear-out-proof! Good-looking, too! Moderate in first cost! Maintenance practically *nil! Mastipave* is something that every maintenance man should know about!

•

Mastipave is manfactured in rolls. Contract Service, for areas of any size, available in any part of the United States.

If you would like to know more about

GRIP-TREAD MASTIPAVE

Send the Coupon!

819

THE PARAFFINE COMPANIES, INC.

Dept. 25-FM, San Francisco, Calif. (or) Somerville, N. J.

☐Send illustrated booklet. ☐Have representative call

☐Send name of nearest contractor

Name..... *Title*.....

Company.....

Address.....

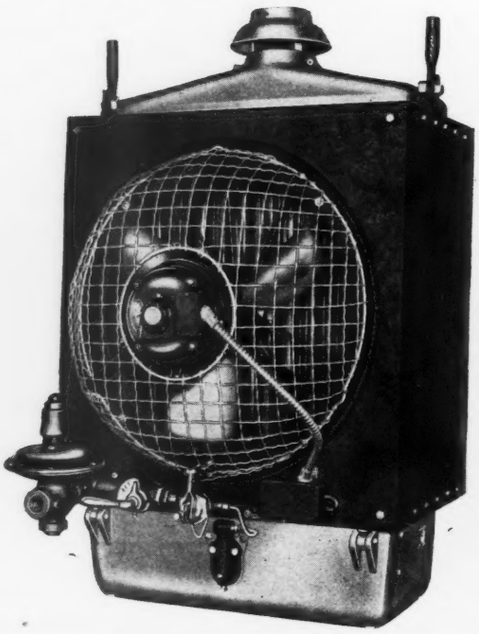
These "Buffalo" UNIT HEATERS

will keep your plant at RIGHT WORKING TEMPERATURES ALL WINTER!

1

"Buffalo" GAS UNIT HEATER

If your gas rate for heating purposes is favorable, you can solve your heating problems quickly, by installing Buffalo Gas Unit Heaters. Fully automatic in operation. Equipped with every necessary safety feature. Quick shipments from stock.



2

"Buffalo" BREEZO-FIN UNIT HEATER

If you have steam available, you can reduce heating costs and be sure of right working temperatures throughout your entire plant and offices with these quiet, efficient Breezo-Fin Unit Heaters. Will operate on either low or high pressure steam. Prompt shipments from stock.

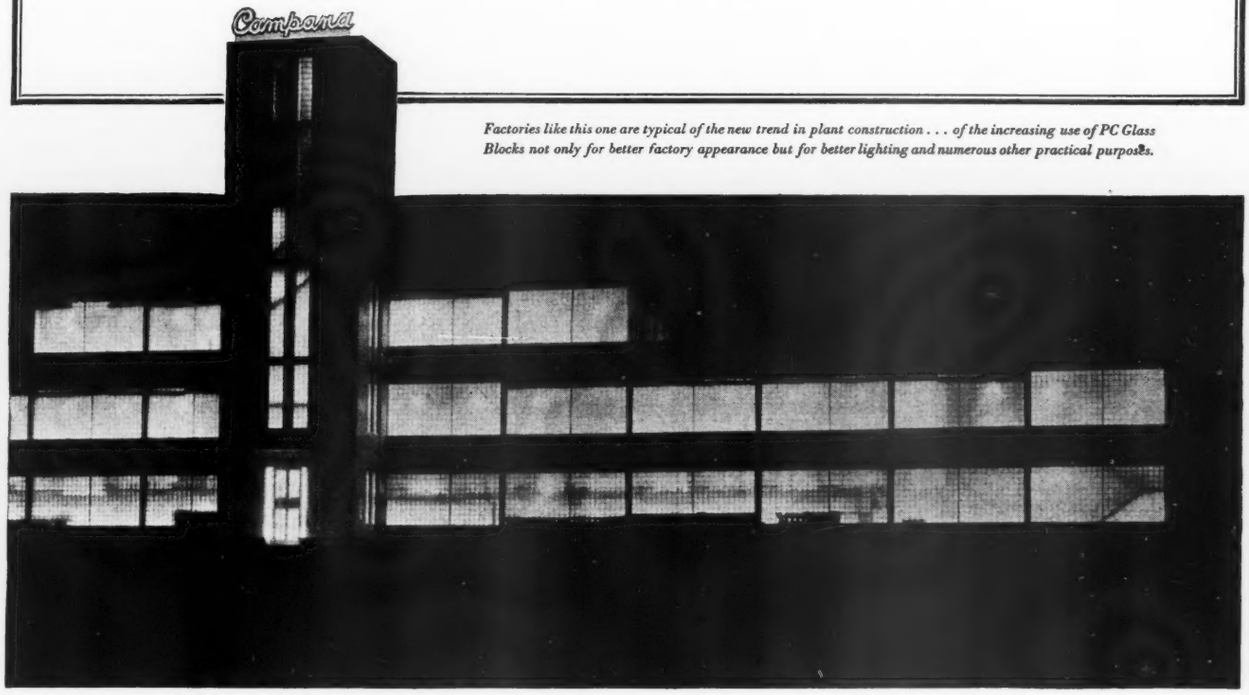
Write for Bulletin 3050.

BUFFALO FORGE COMPANY

471 BROADWAY BUFFALO, N. Y.

BRANCH ENGINEERING OFFICES IN PRINCIPAL CITIES
IN CANADA: CANADIAN BLOWER & FORGE CO., LTD., KITCHENER, ONT.

What PC GLASS BLOCK Construction Can Do for the *Modern Plant*



Factories like this one are typical of the new trend in plant construction . . . of the increasing use of PC Glass Blocks not only for better factory appearance but for better lighting and numerous other practical purposes.

PC Glass Block construction has so many definite and practical advantages that it is able to benefit materially almost every type of manufacturing plant. Here are a few of the ways in which the use of PC Glass Block panels can contribute to better factories and better operating conditions:

1. PC Glass Blocks flood your factory with daylight through insulated light areas, improving plant lighting and working conditions.
2. PC Glass Blocks aid tremendously in successful temperature control.
3. They eliminate dirt infiltration around or through glass areas.
4. They provide a structural material exceptionally easy to clean.
5. They contribute importantly to practical control of plant humidity.
6. They substantially lower maintenance costs by reducing heat loss, by eliminating sash which rots and corrodes, by making cleaning easier and costly repainting and replacement unnecessary.
7. They greatly reduce, or eliminate entirely, condensation of moisture on glass areas.

Send the coupon . . . today . . . for complete facts about PC Glass Blocks. PC Glass Blocks are manufactured by Pittsburgh Corning Corporation, also makers of Carrara Structural Glass.

Distributed by

PITTSBURGH PLATE GLASS COMPANY

and by W. P. Fuller & Co. on the Pacific Coast

PITTSBURGH PC CORNING *Glass Blocks*

Pittsburgh Corning Corporation,
2375A Grant Bldg., Pittsburgh, Pa.

Please send me, without obligation, your new book of facts about PC Glass Blocks entitled "The Glass Age Arrives."

Name_____

Street_____

City_____ State_____

"If I were an ADVERTISING MANAGER"•

That's just one of the talks to be delivered anonymously by a masked speaker that will set every man thinking at the Annual Conference of National Industrial Advertisers Association in Cleveland, September 21-23. A second masked speaker will tell what he would do if he were a publication representative.

We're not going to tell you much here—just highlight the program enough to make your mouth water and your brain tingle.

T. M. Girdler, Chairman, Republic Steel Corporation, is scheduled for the opening address and when "T. M." talks he says something.

J. H. McGraw, Jr. will talk on "What I Would Do *Now* If I Were An Industrial Advertising Manager."

The new Publisher's Statement will receive full discussion.

Clinic sessions, so popular last year, will again cover a wide range of interesting subjects. Two half-day sessions instead of one.

A general conference session will cover such subjects as "Preparing the Plan", "How to Gather Usable Material", "Copy Technique", "How to Sell Management", "Co-ordinating Sales and Advertising" and "How and Why to Use an Industrial Agency."

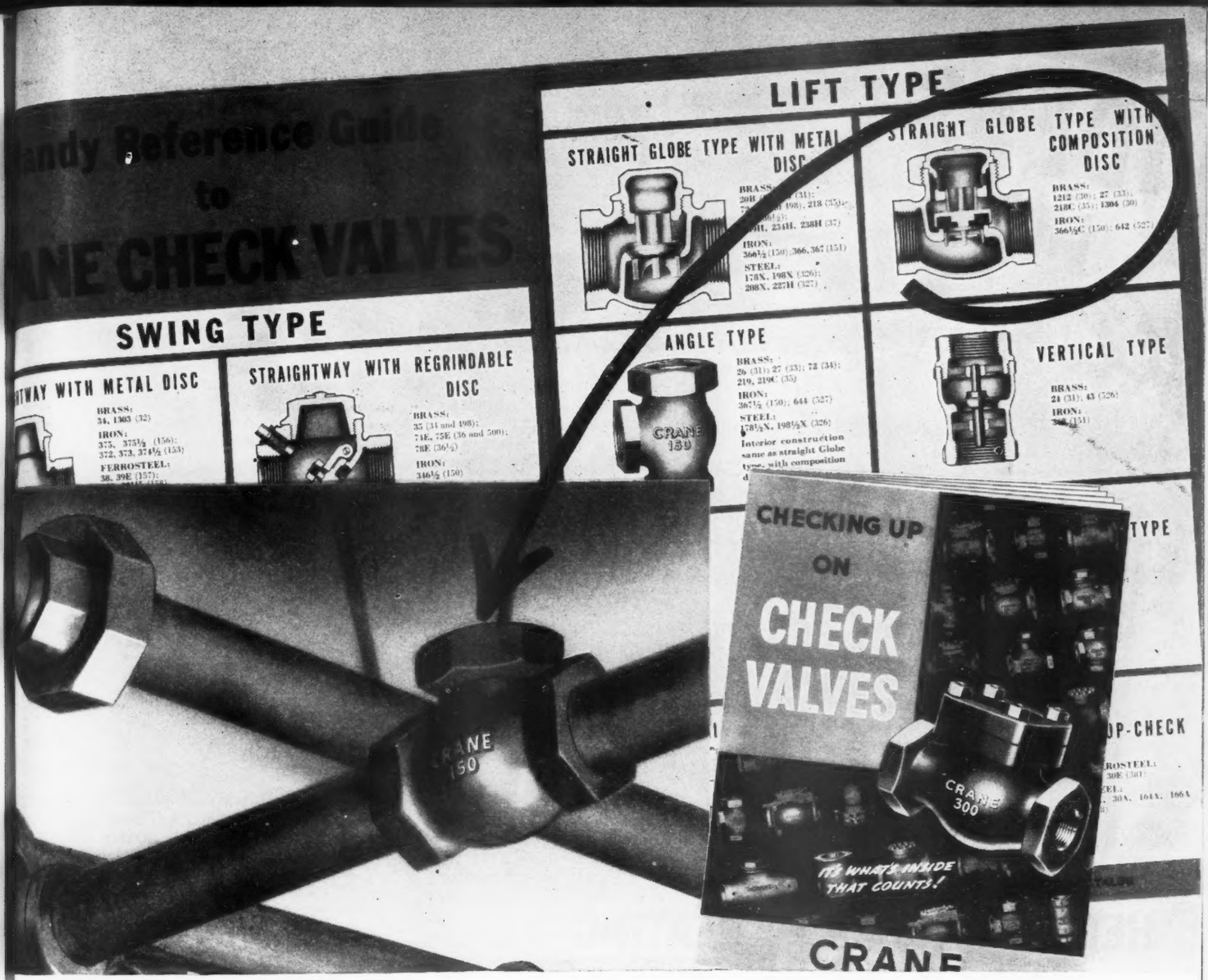
Another session will deal with "Problems of the Small Advertiser", "Production Problems", "Public Relations"—and there are many others.

If I were an Advertising Manager, I certainly would start now to make plans to attend the 16th N. I. A. A. Conference even if I had to hitch-hike to Cleveland. And I would send in my advance registration now to—Ed. Bossart, Bailey Meter Company, Ivanhoe Road, Cleveland, Ohio.

IF I EMPLOYED AN ADVERTISING MANAGER—I would make certain that he attended this Conference, because changing times and markets demand a changed viewpoint—a new viewpoint that can be obtained only by hearing discussions by men whose experience is up-to-the-minute—right up to September 21st.

NATIONAL INDUSTRIAL ADVERTISERS ASSOCIATION

100 EAST OHIO STREET • CHICAGO, ILLINOIS



WHERE TO USE THIS CRANE CHECK VALVE

...IN POWER PLANTS AND FACTORIES

Lift check valves with composition discs are especially suited for service where discs must be renewed easily and quickly. They may be used on steam, air, gas and other vapor lines—provided that flow is not subject to severe pulsations. But that's about as far as general working principles can be applied in check valve selection—be it composition or metal disc lift check, cushioned disc, swing type—or any of their many variations.

Check valves can't be picked by a formula. Crane makes more than 90 types—each designed for a specific service. What type is best suited to your needs and where to use composition or metal discs in lift or swing type valves can be decided only by thorough knowledge of check valves and experience in their use. Your Crane Representative is specially trained in the solution of back-flow control problems. He can offer the valve that is exactly matched to your requirements.

It's What's Inside That Counts!

It goes without saying that satisfactory performance of check valves depends on their quality as well as on selection of the proper type. Crane-Quality, backed by more than 80 years of manufacturing and valve engineering experience, is your assurance of superior goodness in Crane Check Valves all the way through—of proper design to perform efficiently, built right to give lasting service.

"Checking Up on Check Valves"

This new Crane booklet gives a lot of valuable information on the Crane line of check valves for every application. It contains the handy reference guide illustrated above. Write for your free copy today.

CRANE

VALVES • FITTINGS • PIPE
PLUMBING • HEATING • PUMPS

CRANE CO., GENERAL OFFICES: 836 SOUTH MICHIGAN AVENUE, CHICAGO, ILLINOIS

NATION-WIDE SERVICE THROUGH BRANCHES AND WHOLESALERS IN ALL IMPORTANT CITIES

IDEAS that Clicked

1. In the "early days" you wouldn't enter a speed boat race with a single hull. Several extra hulls were required to replace ones shaken and pulled apart by the strain. The hulls couldn't "take it."

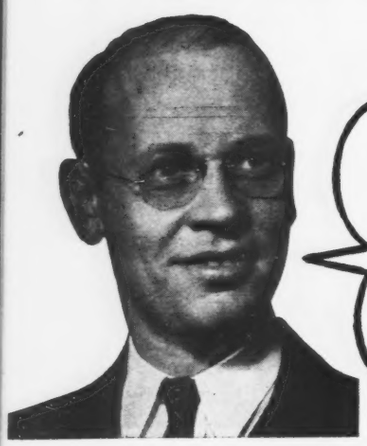
IT'S THE THIRD HULL IN THREE DAYS OF RACING
I HAVE AN IDEA THAT BY FASTENING THE HULL WITH SCREWS IT WILL LAST INDEFINITELY. IT'S WORTH A TRY

2. "Hulls can't be built tough enough for racing speeds," the experts said. But one race mechanic thought differently. He *had an* idea the weakness lay in the hull fastenings. He *thought* screw fastenings would hold.

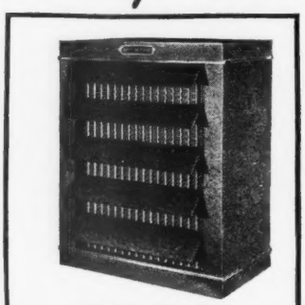
3. So much attention was placed on motors that hull development lagged way behind. But a new idea in boat construction was taking form... Hulls were now being made sturdier, stronger and more dependable—in fact would outlast the motors.

4. An idea that clicked... won fame and fortune for the motor mechanic who now is head of his own boat building concern... Men are winning promotion, prestige, fame and fortune every day by progressive, practical ideas that cut cost in industry—save waste or needless expense.

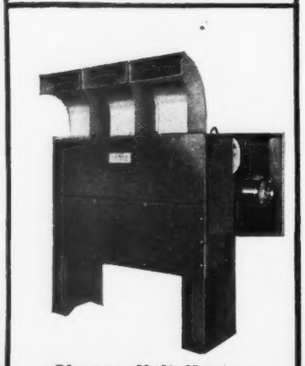
HERE'S AN IDEA IN HEATING *that always clicks*



"I had an idea we could get better heating results with Venturafin Unit Heaters," says J. A. Burchik, maintenance man. "They sure save us money."



Venturafin Unit



Sirocco Unit Heater

HIGH VELOCITY
For Hard-To-Heat Plants

To carry heat long distances requires high outlet velocities and correct design. You get both in the Venturafin Unit Heater with the famous wide area epicycloidal wheel, and you get it with a minimum of noise.

LOW VELOCITY
For Smaller Areas

You can know in advance just how quiet Venturafin Unit Heaters will be by consulting the sound tables in the catalog. This low velocity unit has a low tip speed, low outlet velocity, and quiet operating qualities that are not duplicated in any other heater.

FOR LARGE AREAS

For airplane hangars and other large industrial areas that require a tremendous amount of heat, Sirocco Unit Heaters have proved invaluable. For complete data on the application of Sirocco Unit Heaters in any area, phone or write the nearest American Blower Branch Office.

HEATING SATISFACTION GUARANTEED BY ACCREDITED CONTRACTOR-DEALERS

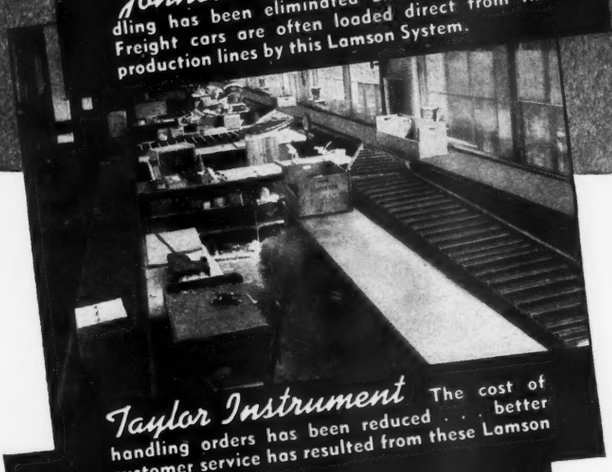
Don't take a chance with ordinary Unit Heaters when you can buy genuine American Blower Units at no extra cost. Just call in the nearest American Blower accredited contractor-dealer and have him make a complete check-up of your equipment. He is a reliable business man and will guarantee heating satisfaction and every bit of work that he does for you. By going to an American Blower contractor-dealer, you are assured of getting not only the finest heating equipment but the best possible heating service at the lowest costs.

AMERICAN BLOWER CORPORATION
6000 Russell St., Detroit, Mich.
Division of the American Radiator and Standard Sanitary Corp. • Canadian Sirocco Co., Ltd., Windsor, Ontario.

AMERICAN BLOWER
Industrial Unit Heaters Keep You Comfortable

LAMSON CONVEYORS *Cut* HANDLING *Costs*

Johnson's Wax Wasteful rehandling has been eliminated and costs reduced. Freight cars are often loaded direct from the production lines by this Lamson System.



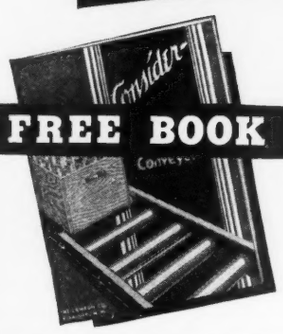
Taylor Instrument The cost of handling orders has been reduced . . . better customer service has resulted from these Lamson Conveyors.

Limoges China Operating costs were cut $97.84 per working day by this Lamson installation in this Ohio China plant.

in these well-known plants

Whether it's a pottery, a wax factory or an instrument manufacturing plant, LAMSON CONVEYORS smooth out complicated handling problems. They keep raw and finished materials, empty cartons, shipments moving steadily, efficiently and economically. They eliminate needless walking, cross-hauling and rehandling.

Whatever your materials handling problem, LAMSON engineers will be glad to study your needs and devise a system, with suitable LAMSON CONVEYORS, to meet your requirements. Write for our latest booklet which shows you the many types and uses of LAMSON CONVEYORS. And ask for the LAMSON engineer residing nearest you to call to look over your plant. There is no obligation.



FREE BOOK Shows New Ways of Cutting Production Costs

THE LAMSON COMPANY, INC.
Syracuse, N. Y.

☐ Send me without obligation a Free Copy of your Conveyor booklet.

☐ Have your nearest Sales Engineer call.

Name .....

Company .....

Address .....*State*.....

By the Carload . . .

By the Pound . . .

For Roughing . . .

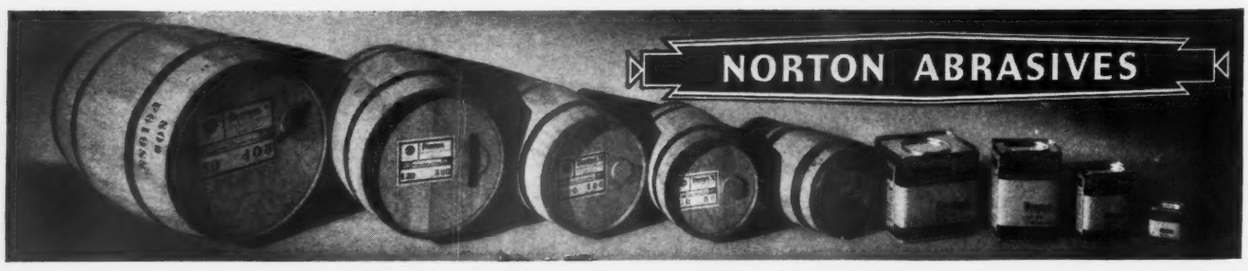
For Finishing . . .

ALUNDUM ABRASIVE

FROM the coarse sizes for the first roughing operations down to the finest sizes for finishing, you'll like the way that Alundum Abrasive will cut polishing costs. Special shaping operations give a fast cutting grain; its high capillarity gives a strong, long-lasting wheel head. And special Norton Sizing methods assure exceptional uniformity in Alundum Abrasive—grain that gives the surface you want for buffing and plating.

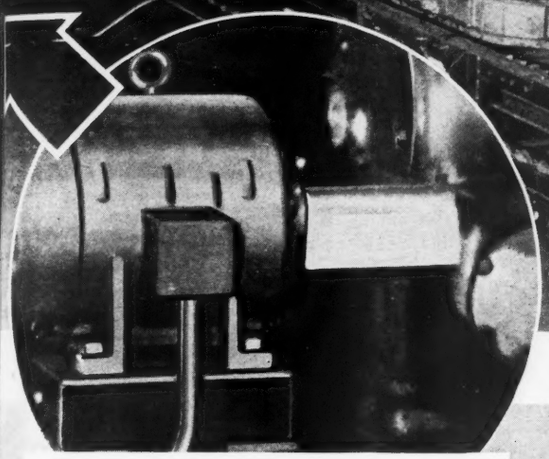
NORTON COMPANY, WORCESTER, MASSACHUSETTS

New York Chicago Detroit Philadelphia Pittsburgh Hartford Cleve'and
Hamilton, Ont. London Paris Wesseling, Germany Corsico, Italy

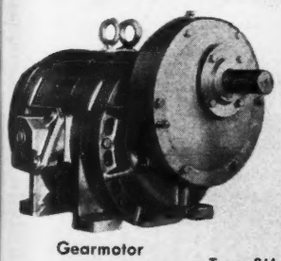


XAMPLES OF PRACTICAL PARTNERSHIP IN CONVERTING POWER INTO PROFITS

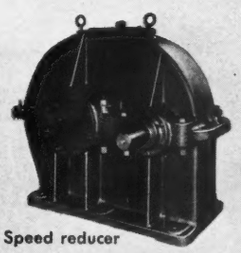
40 MOLDS PER HOUR INSTEAD OF 28 with WESTINGHOUSE-DRIVEN CONVEYERS



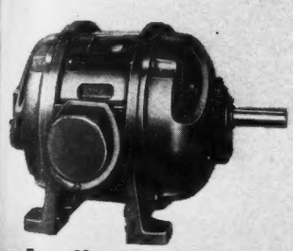
Large illustration pictures Westinghouse motor on conveyer line, while close-up shows details of this individual motor. Westinghouse controls, matched to the drive, keep all movements under the operator's finger tips. Below . . . a few typical products from the complete Westinghouse line of electrical equipment for industry.



Gearmotor



Type SH Speed reducer



Type CS motor

Combination "De-ion" linestarter

Typical advantages of modern conveying equipment illustrated by Mathews Conveyer with Westinghouse drive.

Faced with the problem of speeding up production of heavy castings, a manufacturer of railroad and automotive devices installed Mathews conveyers, driven by Westinghouse . . . and increased the number of molds handled from 28 to 40 an hour . . . 96 more in an 8-hour day. The complete installation comprises twin systems, including conveyers, roll-over drag machines, cope machines, storage lines for pouring and cooling and shakeout stations. Molds handled are 57″ x 30″, with a maximum total weight of 5,000 pounds.

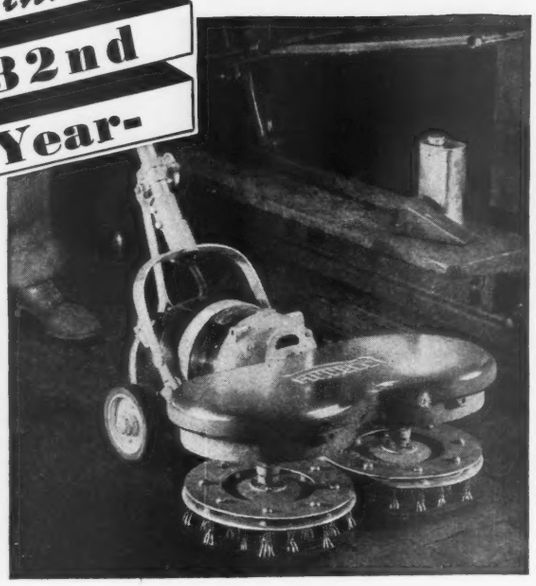
Westinghouse worked with the manufacturer and with Mathews Conveyer Company engineers, to develop exactly the right drives and controls to fit the peculiarities of the job . . . with the result that production is now handled with a minimum of time, effort and expense.

This is just another example of Westinghouse practical partnership in converting power into profits. For *your* electrification needs, see your local Westinghouse office, or write Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. J-93857

Westinghouse

ELECTRICAL PARTNER OF INDUSTRY

Finnell's 32nd Year-



— IN THE INTEREST OF

Cleaner, More Sanitary

FLOORS

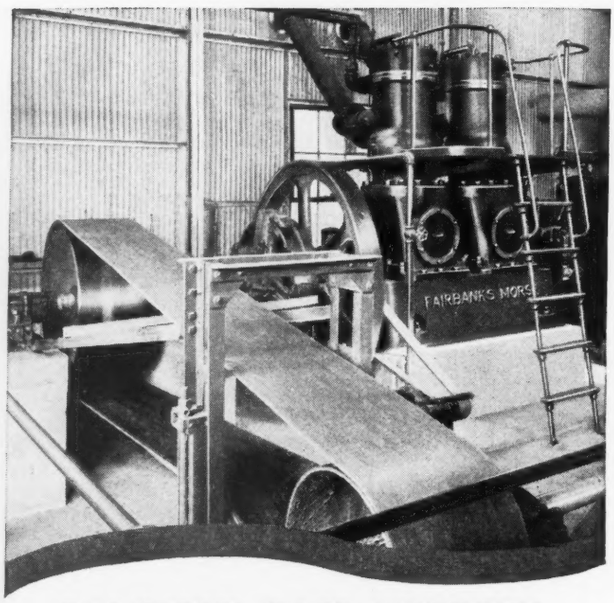
For almost a third of a century the Finnell System has been maintaining and treating floors of every type, keeping new floors new and old floors clean and sanitary,—at less cost than obsolete methods. For more than three decades Finnell has been solving floor problems, ever enlarging their service by developing new equipment to meet new requirements, until today the line includes 35 different sizes and types and represents the most complete line of floor-maintenance equipment available.

Illustrated above is a heavy duty Finnell. In factories with wood, wood block or cement floors, it's a necessity. Its two scarifying brushes literally dig through and completely remove heavy coatings of dirt, oil, grease and steel shavings, and they do this in an incredibly short time. Brush rings may be replaced with conventional tampico or palmetto brushes and used for scrubbing, steel-wooling, waxing or polishing.

For surveys, demonstrations, literature or samples of floor supplies, please see your phone book for nearest branch. Or, write Finnell System, Inc., 2509 East Street, Elkhart, Indiana.

FINNELL SYSTEM

OF FLOOR MAINTENANCE



F-M DIESEL CASE HISTORIES

(Cotton Gin)

$450 less than Steam

IN ONE SEASON

● Recently the Clio Gin Co., of Alexandria, La., replaced steam power with a Fairbanks-Morse Model 32-E 2-cycle Diesel engine. During the first ginning season following installation, power cost was $450 less than steam power would have cost for the same operating period.

Call the roll of industry throughout the nation. Name any kind of industrial plant. The answer is always the same—F-M Diesel power is proving its case in cold black and white figures that represent money saved.

In the cotton gin, for example, it is always costly to raise steam for ginning a few bales—and hold it there all day awaiting more. But the F-M Diesel engine can be started and shut down, and when it is shut down—power cost stops.

What Fairbanks-Morse Diesel power can do for you can be accurately determined in advance of installation. Write Department 30, Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago, Ill. 35 branches throughout the United States at your service.

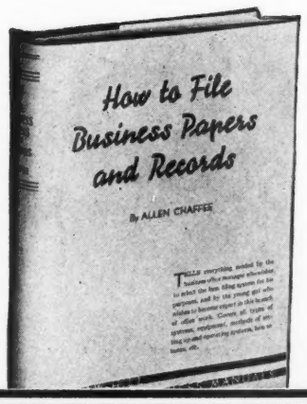
When it's even too hot for a Hottetot, *COMFORTIZE* with Fairbanks-Morse air conditioners.

7337-0A40.141

FAIRBANKS-MORSE

DIESEL ENGINES · PUMPS · ELECTRICAL MACHINERY · FAIRBANKS SCALES · RAILROAD EQUIPMENT · WATER SYSTEMS · REFRIGERATORS · RADIOS · WASHERS · FARM EQUIPMENT · STOKERS · AIR CONDITIONERS

F-M Diesels



Which one of these business primers will help YOU to a better job?

1 HOW TO FILE BUSINESS PAPERS AND RECORDS

By Allen Chaffee. Explains methods of filing and indexing. Describes all systems of filing, from simplest to those requiring special equipment, and how to operate them. Rich in material for office managers who wish to compare, select, and maintain best filing systems for their purpose, and for business girls who want to become expert at filing. 186 pages, illustrated, $2.00.

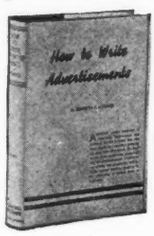
2 HOW TO SELL BY MAIL

By Earle A. Buckley, Direct-mail Consultant. Outlines the use of mail advertising to secure direct orders for merchandise or services. For all who want a quick view of fundamentals, preparation of advertising material, handling of lists, mailings, tests, records, etc.; shows plainly what to do and how to do it to secure best results, 212 pages, illustrated, $2.00.

3 HOW TO USE YOUR BANK

By William H. Kniffin, Vice President, Bank of Rockville Centre Trust Company. Shows what the banker's problems are in providing practical services, how both banker and customer have something the other wants, and how, from the depositor's or borrower's viewpoint, the business man may use this knowledge to better advantage in everyday dealings with his bank. 218 pages, $2.00.

4 HOW TO WRITE ADVERTISEMENTS



By Kenneth S. Howard. A concise treatment of fundamentals and practices, for the business man who must handle his company's advertising along with other duties. Covers basic advertising psychology, practical details of advertising writing and production, and special pointers applying to the advertising of various types of businesses. 257 pages, $2.00.

5 HOW TO WRITE BETTER BUSINESS LETTERS

By Earle A. Buckley. Outlines the methods used by successful business letter writers, together with practical pointers on how to apply these methods to specific problems in the preparation and dictation of better business letters. Includes a wealth of usable material—successful letters, effective openings, action-getting closing paragraphs, etc. 184 pages, $2.00.

6 HOW TO GET PUBLICITY

By Milton Wright. The tools, the techniques, the whole art of getting publicity for your enterprise, large or small, are fully and plainly covered. The author, an experienced publicist, covers every factor of how to prepare and handle material, and where and how to get publicity, in a way that meets the business man's needs. 226 pages, $2.00.

McGRAW-HILL PRACTICAL BUSINESS MANUALS

- *give you a bird's-eye view of essentials in important business fields*
- *show you practical methods that get results*

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Send me the books checked for 10 days' examination on approval. In 10 days I will pay for the books plus a few cents postage or return them postpaid. (Postage paid on orders accompanied by remittance.)

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- ☐ Kniffin's How to Use Your Bank, $2.00
- ☐ Howard's How to Write Advertisements, $2.00
- ☐ Buckley's How to Write Better Business Letters, $2.00
- ☐ Wright's How to Get Publicity, $2.00

Name .....

Address .....

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Position .....

Company Fac-9-38

(Books sent on approval in U. S. and Canada only.)

CUT WATER COSTS

SAVINGS OF 25% TO 75% WITH DEMING DEEP WELL TURBINE PUMPS

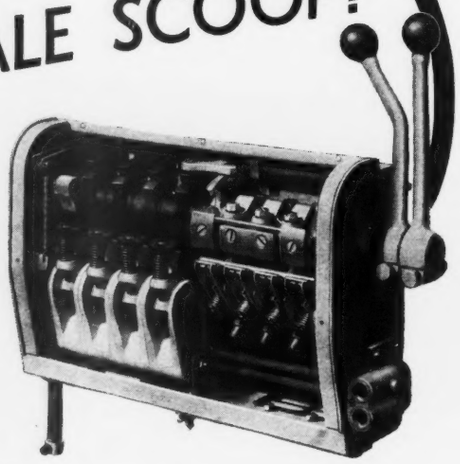
● The cost of a deep well on your own property with a Deming Turbine Pump is soon paid for by savings on water costs. For example: a Deming Turbine Pump cuts water costs from 15 cents to 4.9 cents per 1000 gallons for an Ohio concern. Many comparable installations are on record.... A Deming *water lubricated* Turbine Pump delivers water pure and clean as there is no oil or grease required on any moving parts located in the well. (The water being pumped supplies the necessary lubrication).

Send for catalog bulletin describing Deming Deep Well Turbine Pumps. If you are interested further, a Deming engineer will help you select the correct equipment for your requirements.

DEMING *Pumps*

THE DEMING CO. • SALEM, OHIO

ANOTHER YALE SCOOP!



THE CAM-O-TACTOR

Once again Yale paces the field with a brand new Electric Truck engineering advance—Cam-O-Tactor Control.

Entirely different—this new type controller combines the high current interrupting capacities and long life of contactors with the positive action and safety of mechanical cam-operation. In addition it accomplishes the make and break contacts without creating the usual sticking or welding of electrical surfaces . . . EVEN WHEN UNDER EXTREME VIBRATION OR FLUCTUATION OF VOLTAGE!

And don't forget—ONLY Yale trucks can bring you these outstanding improvements because ONLY Yale trucks feature Cam-O-Tactor Control! For further particulars contact the nearest Yale representative or send for Free Folder.

FREE FOLDER

Complete details on Cam-O-Tactor Control. You should know all about this very latest development. A Folder is yours without obligation. Just send for it.

YALE

THE YALE & TOWNE MFG. CO.

PHILADELPHIA DIVISION
PHILADELPHIA, PA., U. S. A.

BLAW-KNOX *Electroforged* GRATING

-the choice of industry *because*

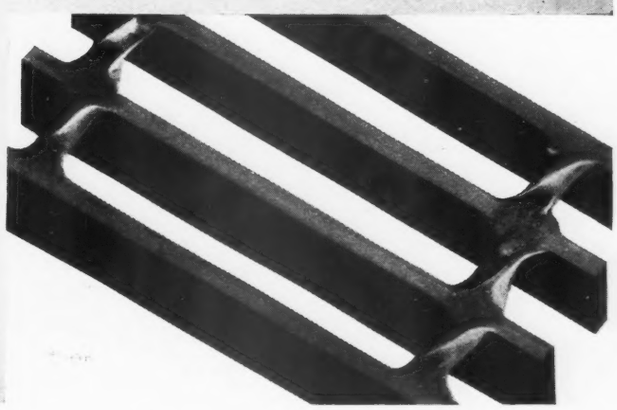
Maximum open area for light and air

Safest footing because of the twisted bar

Easily maintained no cracks, or crevices, paint reaches entire surface

Electroforged one piece construction strongest by test

Self cleaning no sharp corners to clog with debris



Send for free paperweight size sample.

OTHER BLAW-KNOX PRODUCTS

Rolls—Rolling Mill Equipment—High Temperature Furnace Equipment—Welded Pressure Vessels and Equipment for Special Processes
Steam Purifiers
Construction Equipment
Radio Broadcasting Towers
Standard Steel Buildings
Clamshell Buckets
Steel Castings
Alloy Castings
Power Piping Systems
Automatic Sprinkler Systems
Electrochemical Process Units

USE THE COUPON

BLAW-KNOX DIVISION of Blaw-Knox Co., 631 Farmers Bank Bldg., Pittsburgh, Pa.

NAME _____ COMPANY _____

STREET _____

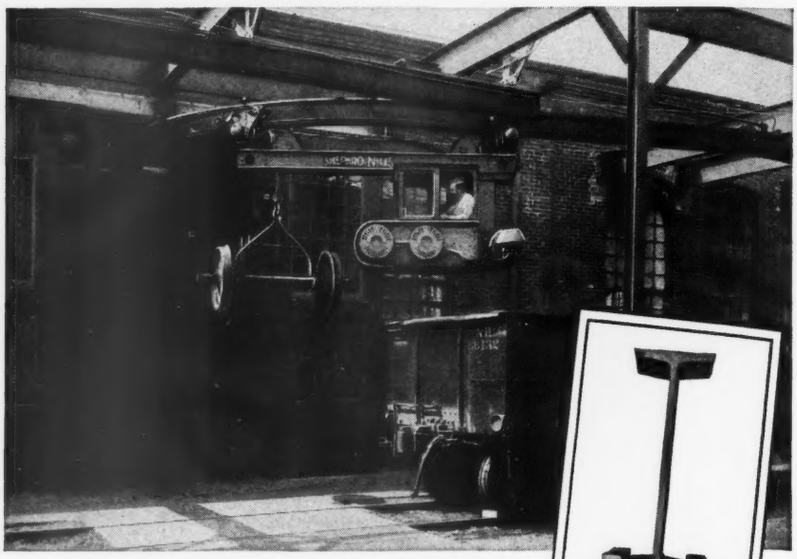
CITY _____ STATE _____

AERIAL RAILWAY *of Industry*

● One Shepard Niles electric monorail hoist gives "express service", indoors or out, to any point in the plant or yard carrying loads of every description. Furnished with single or double hooks in capacities from ⅛ to 10 tons.

They are also ideally suited to the accurate control of any standard electro-magnet or grab bucket.

Write for catalogs illustrating and describing the "Aerial Railway of Industry".



Several departments in two separate buildings are served by this Shepard Niles monorail ho st.

Shepard Track consisting of two special analysis T-rails clamped to the bottom flange of a standard I-Beam insures a smooth, hard, long-wearing track for monorail hoists.

A COMPLETE LINE OF CRANES & HOISTS

SHEPARD NILES CRANE & HOIST CORP.

364 SCHUYLER AVENUE... MONTOUR FALLS, N.Y.

BUNTING *Bunting* ***Quality***

BRONZE BUSHINGS • BEARINGS
PRECISION BRONZE BARS
BABBITT METALS

ALWAYS IN STOCK

Hundreds of different sizes of completely finished bronze bearings for all mechanical applications. • Electric Motor Bearings for all makes of motors from 1/50 hp to 100 hp. • Bunting Precision Bearing Bronze Bars machined I.D., O.D. and ends, solid bars centered. • Lead Base and Tin Base Babbitt. • Write for catalog or ask your supply wholesaler... The Bunting Brass & Bronze Company, Toledo, Ohio... *Warehouses In All Principal Cities.*

Announcing

Locklite

Lights When It's Locked and Only When It's Locked

The Maintenance Man knows it's firmly locked when it lights.

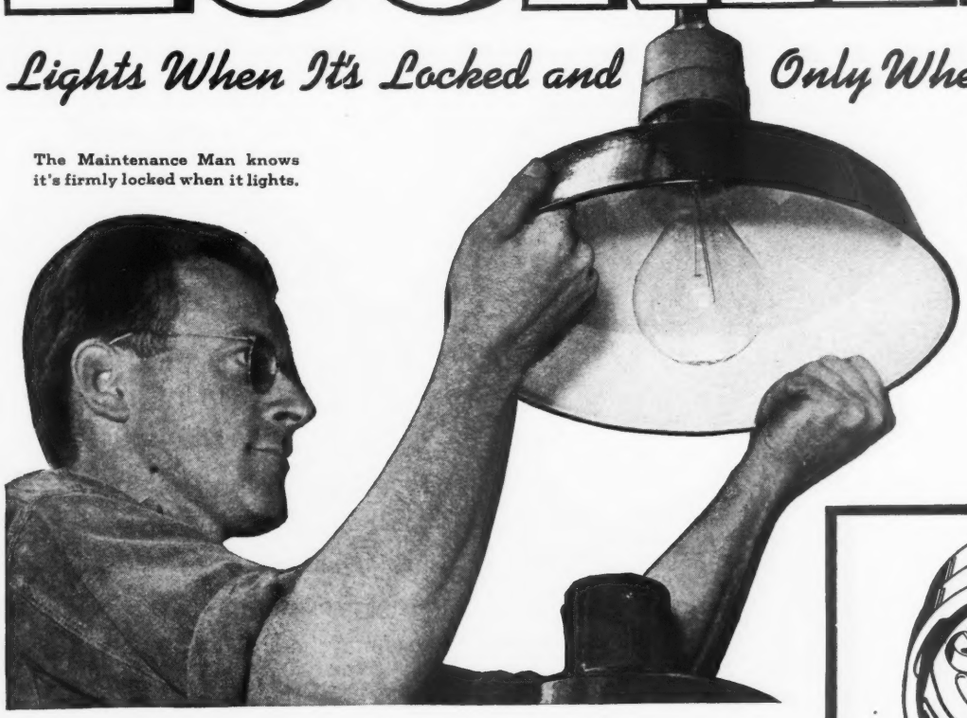
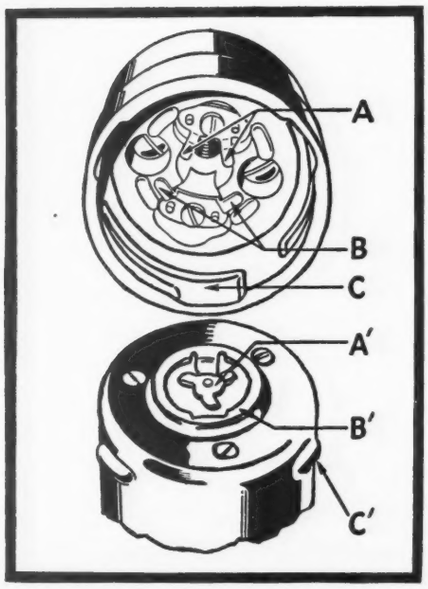


Figure 1 below, shows the new LOCKLITE Hood and Reflector Neck...with electrical contacts designated as A and A^1, B and B^1. Positioning slots in the Hood and corresponding lugs on the Neck of the Reflector are designated C and C^1. The latter are engaged by giving the Reflector an easy turn of 60° clockwise.



AN INGENIOUS NEW PRINCIPLE OF INDUSTRIAL REFLECTOR SUSPENSION

"LOCKLITE" is the Westinghouse name for an exclusive, new electrical and mechanical connecting and disconnecting principle . . . providing an ingenious and entirely different type of industrial reflector suspension.

This principle is embodied in the construction of the RLM Standard Dome, Deep Bowl and Symmetrical Angle Reflectors; also in the Shallow Dome Reflector and Glassteel Diffuser . . . all manufactured by Westinghouse.

Take advantage of LOCKLITE benefits in your own plant...including ease of installation, higher over-all lighting efficiency, greater safety and complete interchangeability of Reflector units.

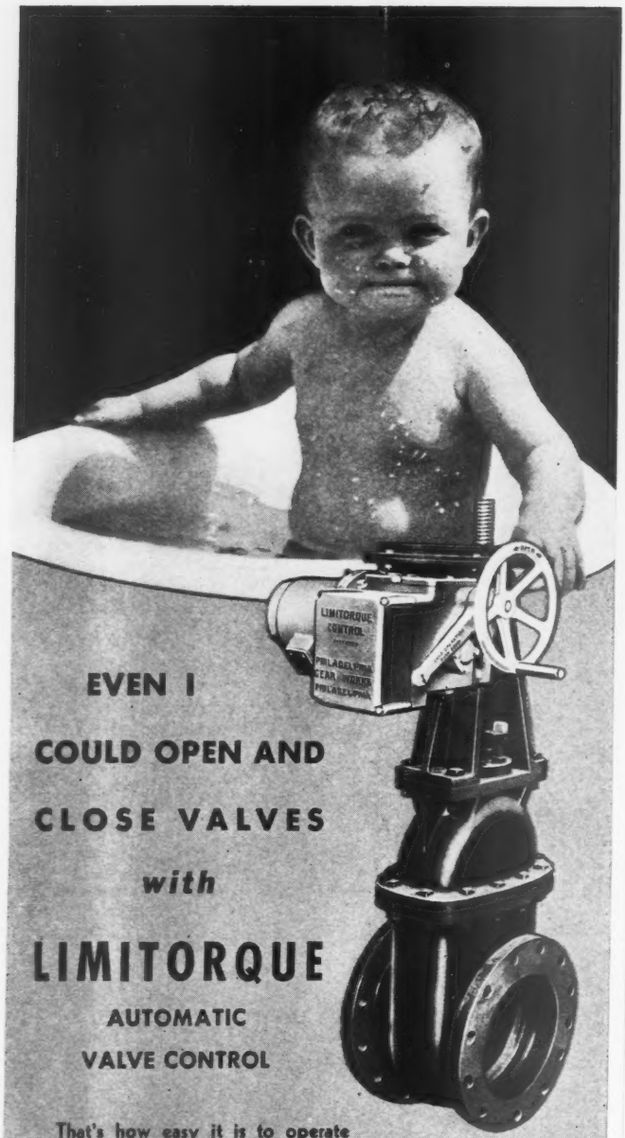
For "reasons why" call your nearest Westinghouse Jobber and ask to see LOCKLITE features demonstrated at your own desk; or write for further details to Westinghouse Electric & Manufacturing Co., Lighting Division, Edgewater Park, Cleveland, Ohio.

Westinghouse is a member of

RLM STANDARDS INSTITUTE

WHEN YOU THINK OF *Lighting Equipment* THINK OF

Westinghouse



EVEN I COULD OPEN AND CLOSE VALVES *with* LIMITORQUE AUTOMATIC VALVE CONTROL

That's how easy it is to operate valves equipped with Limitorque Control. Just pushing a button opens and closes the biggest of them, even though the valves are located in out-of-the-way spots.

Another advantage of Limitorque is the protection it assures against breakage or damage to valve stems or gates by automatically limiting the torque applied to the valve stem. Expensive replacements, inconvenient shut-downs and general disruption of schedules are thus prevented.

Philadelphia Limitorque Control is readily adapted for opening and closing globe, gate, Penstock and rotary plug valves as well as many other operations. It fits any make of valve and can be installed on present equipment, if you wish.

For installations where it is not desired to attach the control unit directly to the valve yoke, Floor Stand Controls can be furnished.

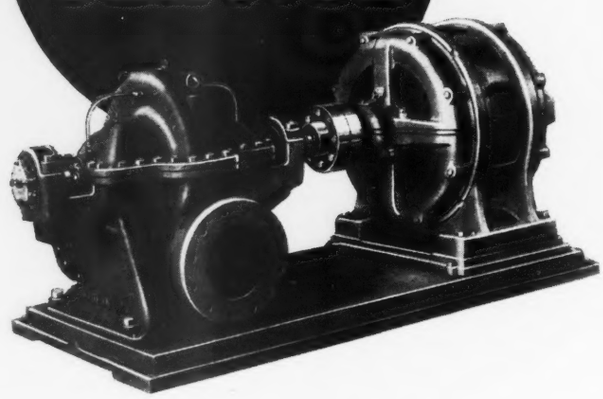
Write us for details or our recent catalog.

PHILADELPHIA GEAR WORKS

Industrial Gears and Speed Reducers

ERIE AVENUE AND G STREET, PHILADELPHIA

FOR GENERAL SERVICE



● Goulds Fig. 3450 Double Suction Centrifugal Pump is particularly suited for general water supply, municipal waterworks, circulating and booster service, low pressure boiler feed, and for the handling of miscellaneous liquids in industrial process work. This pump has established an unmatched record for reliability and low cost operation.

Accurately machined and carefully balanced bronze impellers eliminate vibration and make for low power consumption.

Heavy duty ball bearings maintain perfect alignment without adjustment.

Seven sizes provide capacities up to 15,000 g.p.m. at heads up to 250 feet.

Standard fitted, all iron and all bronze constructions are available. Pumps can be supplied for direct connected electric motor, steam turbine, gasoline engine or for belt drive. Ask for Bulletin No. 200B.

GOULDS PUMPS Inc.

ATLANTA, BOSTON, CHICAGO, HOUSTON, NEW YORK, PHILADELPHIA, PITTSBURGH, TULSA. Representatives in all Principal Cities

8307

Calibration
Responsiveness
Sensitivity

3 tests

...FOR THERMOMETERS THAT DETERMINE OPERATING ECONOMY

1.

Calibration: The ability to register accurately at all points on the chart scale. *Foxboro assures bull's-eye accuracy over the entire chart range.*

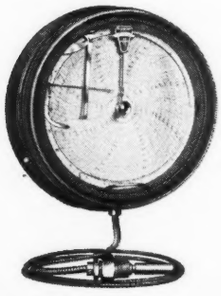
2.

Responsiveness: The time required to record a variation in temperature. *Foxboro Thermometers are faster than any process change.*

3.

Sensitivity: The ability to react to minute temperature variations. *Foxboro Thermometers are sensitive to the slightest variation.*

. . . they are lasting qualities of the mono-therm system



Every user agrees that thermometers can be no better than their thermal systems. That is one of the reasons why so many prefer Foxboro Recording Thermometers. The Foxboro *mono-therm* Thermal System has been made into one permanently sealed integral piece of metal which is secure against vibration, shock, or overrange temperatures and the loss of accuracy experienced with inferior constructions.

Moving parts of the recording mechanism are light yet strong. Fixed parts are rugged. Thus, friction and inertia are practically eliminated and permanent alignment assured. Every detail demonstrates the quality of workmanship, the design, the engineering skill which combine to provide lasting accuracy and response. Users agree all of these features mean just this: you get the most for your money when you buy Foxboro Recording Thermometers. Write for Bulletin 198-1. The Foxboro Company, 24 Neponset Ave., Foxboro, Mass., U. S. A. Branch offices in 25 Principal Cities.

FOXBORO

REG. U. S. PAT. OFF.

RECORDING THERMOMETERS

VACUUM
REACHES EVERYWHERE

It cleans walls, ceilings, and pipes faster at less cost. Health and fire hazards are reduced. Machinery is cleaned more frequently and at less than half the cost. Production conditions are improved by removing refuse as it accumulates. In the watch, food and radio industries dust is kept from the product during the process of manufacture. Valuable dusts and materials can be reclaimed. Shipping containers and finished product cleaned at low cost. And operating engineers are finding new uses every day. Try a Spencer Portable, or let our engineers figure what a complete Central System could do in your plant.

SPENCER HARTFORD

CENTRAL AND PORTABLE VACUUM CLEANING SYSTEMS

123-C

THE SPENCER TURBINE COMPANY, HARTFORD, CONN.

UNBRAKO

SOCKET SCREWS

LIVE UP TO THEIR 20 YEAR REPUTATION FOR ACCURACY UNIFORMITY AND DEPENDABILITY

All three of these characteristics must be inherent parts of socket screws purchased for production work. Failure of any one, slows up operation or makes a possible "weak spot" in the finished product.

Buy the kind that have been known and liked throughout all lines of industry for more than two decades. Specify "Unbrako" for all your socket screw requirements. Write us now for literature, prices and samples.

Fig. 232. "Unbrako" Hollow Set Screw—for years it has been preferred in countless shops. Finest alloy metals—accurately machined, expertly heat treated.

Fig. 1564. (Pat. Pend'g) "Unbrako" Self Locking Hollow Set Screw. Once it's tightened, it will not work loose unless a wrench is applied. Can be re-used.

Fig. 1434. (Pats. Pend'g) Knurled "Unbrako" Socket Head Cap Screw. Another favorite because of its obvious advantages.

STANDARD PRESSED STEEL CO.

JENKINTOWN, PENNA.

BRANCHES: BOSTON, DETROIT, INDIANAPOLIS

Box 546

BRANCHES: CHICAGO, ST. LOUIS, SAN FRANCISCO

Increase the

MAN POWER

rating of your business

BACK of every business success is the human element. No organization with a poorly selected personnel can be long successful. No organization with a wisely chosen body of employees can be anything but successful.

Every man who goes on your payroll should be employed only after a rigid weeding out process. An advertisement in *Factory Management and Maintenance* is the first step toward eliminating the undesirables, for only sincere, intelligent, and forward looking men read this paper regularly. They are the kind of men you want in your employ. They are the kind of men you *must* have if *your* business success is to be assured.

Take the first step toward increasing the MAN POWER rating of your business by using the employment advertising service of *"Factory."*

Address

Departmental

Advertising Staff

330 West 42nd St.
NEW YORK, N. Y.

(A PLANT ELECTRICIAN OPINES)

"A ROCKBESTOS JOB Lasts forever"

Why incur the expense of frequent replacement of circuits exposed to high temperatures when the specification of Rockbestos asbestos insulated wire or cable means a *permanent job* . . . a job that will last as long as the circuit is needed, whether it's 5 years or 50 years! Heat won't dry out the insulation, it won't crack under vibration, it won't burn and it is highly resistant to the action of corrosive fumes, oil or grease.

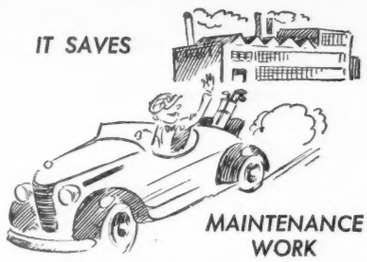
One booster, an experienced plant electrician, recently wrote us . . . "Rubber-covered and slow-burning power feeders lasted one or two years in a tunnel that carried a steam line. In 1932 I installed Rockbestos and recent megohm tests show over 50 megs. I suppose it will last forever."

Be like this man. Get rid of irritating and expensive periodic replacements. Install Rockbestos. You'll find the wire or cable you need in our catalog, and we'll send you a sample for inspection and test if you wish. Rockbestos Products Corporation, 896 Nicoll St., New Haven, Conn.

Also refer to Electrical World Buyer's Reference Number of 1938.

AW ADEQUATE WIRING SERVES AND SAVES

OTHER ROCKBESTOS FEATURES



Rockbestos wired circuits eliminate frequent and expensive replacement.

IT IS VIBRATION-PROOF

Rockbestos insulation won't dry out, crack, open up, or fall off.

Rockbestos won't rot, bloom or swell under action of oil, grease or fumes.

IT HAS GREATER CARRYING CAPACITY

Rockbestos' greater carrying capacity saves conduit replacement, labor and money.

IT IS HEATPROOF

Rockbestos insulation, made of asbestos, does not deteriorate under heat. It's flame-proof, too.

ROCKBESTOS A.V.C.—*the wire with permanent insulation*

Giving Business a Big Lift

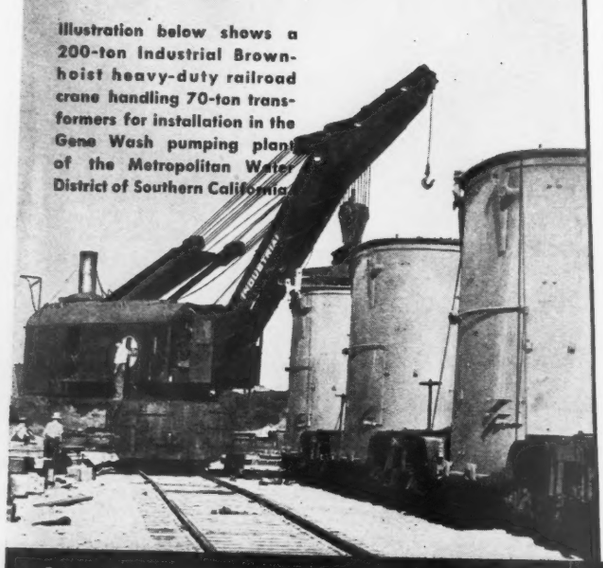


Illustration below shows a 200-ton Industrial Brownhoist heavy-duty railroad crane handling 70-ton transformers for installation in the Gene Wash pumping plant of the Metropolitan Water District of Southern California.

Cost reduction is a much discussed subject among plant executives these days. One big lift in that direction is to cut material handling costs. If you doubt it, just ask any user of a new Industrial Brownhoist crane.

Frankly, some of these users were skeptical when they called us to study their plant layout and handling methods. But a cost comparison quickly showed the advantages of Industrial Brownhoist cranes—their greater speeds, dependability and their ability to handle all kinds of materials as well as to do the yard switching. Today, the handling costs in these plants are at rock bottom.

If you suspect your handling costs of being out-of-line, you've much to gain and nothing to lose by comparing them with those of a new Industrial Brownhoist crane. One of our sales engineers will gladly go over your layout and give you his figures at your convenience. When shall he call?

INDUSTRIAL BROWNHOIST

GENERAL OFFICES: BAY CITY, MICHIGAN
DISTRICT OFFICES
New York, Philadelphia, Pittsburgh, Cleveland, Chicago,
Agents in Other Principal Cities

LABOR COSTS CUT 60% TO 70% *when* NITROSE *. . . is used*

Nitrose can be applied with only a third the labor ordinarily required. No expensive preparatory work necessary—no second coat needed when you use this time-tested protective covering for metal surfaces. Effectively resists corrosion under severe conditions — offers long-time protection in general maintenance work at no more cost than ordinary paints. Write

THE NITROSE CO., INC. • PEORIA, ILL.

Industrial TRUCKS *for Every Purpose*

• Wherever you look through modern industry—manufacturing, commercial or institutional—you will find Colson Trucks in daily use.

You will be impressed, too, from the smallest caster to the largest truck with the carefulness of design and substantial manner in which Colson builds.

THE COLSON CORPORATION
346 CEDAR STREET • ELYRIA, OHIO

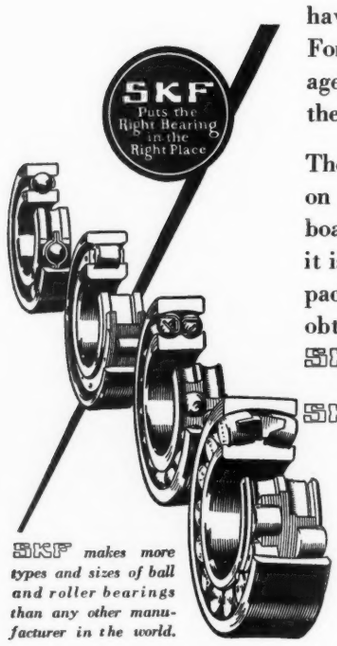
Bring your truck needs to **Colson**

Built by Cunningham Machinery Corp. SKF-EQUIPPED

SAWS ARE FRICTION-FREE WITH SKF PILLOW BLOCKS

When this saw sinks its teeth into a tough board, Friction doesn't have a chance to raise power, maintenance and lubrication costs. For an SKF Pillow Block protects the bearing from lubricant leakage, dust, dirt and moisture . . . chases Friction out of the plant and the red out of production records.

There may be a troublesome bearing somewhere in your plant . . . on fans, blowers, pulverizers . . . or other equipment having outboard bearings. If there is, change over to an SKF and know what it is to be free from Friction's expensive dragging load. Strong, compact units, SKF Pillow Blocks consist of only a few parts and may be obtained for any shaft size from 5/8" to 30" in diameter. Your nearest SKF distributor will be glad to supply you further information.



SKF makes more types and sizes of ball and roller bearings than any other manufacturer in the world.

SKF INDUSTRIES, INC., PHILADELPHIA, PENNA.

4166

SKF

BALL & ROLLER BEARINGS

THE DUST HOG IS ALWAYS FIRST IN LINE TO GET . . .

YOUR MONEY!

BUT, he never collects under his own name. He is too smart for that, too subtle, too patient.

He gets "his" casually from *your* plant every day under such alias as:

"Wear and Tear"
"Spoilage"
"Accidents"
"Lost Time"
"Inefficiency"

and many other famous nom de plumes.

As long as the Dust Hog is in your plant you pay and pay and pay! Isn't it time for a Barbecue?

That's where **PANGBORN** can do you a good job. Our twenty-five years of successful experience in designing, building and servicing all types of Dust Collectors is placed at your service. If you aim to control *profits* you must control the Dust Hog first. He is a costly hazard and should be converted **NOW** into a profit paying by-product. No matter how large or small your problem let us tell you our plan at once. Write today.

PANGBORN

THE WORLD'S LARGEST MANUFACTURER OF DUST CONTROL AND BLAST CLEANING EQUIPMENT

PANGBORN CORPORATION · HAGERSTOWN, MD.

3 is better than 10!

THESE 3 EAGLE BEARING METALS

meet most bearing metal requirements

Eagle Bearing Metals are made to Controlled Specifications . . .

EAGLE DREADNAUGHT
For extreme speed and pressure conditions.

EAGLE OUTLASTA
For medium speed and pressure conditions.

EAGLE DURABLE
For low speed and pressure conditions.

Sold through recognized distributors

Protect Your Equipment . . . Insist on Eagle's *Controlled Specifications*

● A single bearing metal failure causes plenty of grief—costs plenty of money. Avoid costly shutdowns by specifying Eagle Bearing Metals. They are made only of clean, primary metals that are scientifically alloyed under strict pyrometric control. Uniformity and long life are assured. Eagle Bearing Metals contain no hard spots to cut and score the shaft. Their use helps guarantee trouble-free operation.

THE EAGLE-PICHER LEAD COMPANY
CHICAGO • JOPLIN • CINCINNATI

EAGLE EP PICHER

Reduce Your Market Liabilities!

TAKE HOME a hundred recent reports of calls made by salesmen —and then ask yourself "what can I do to help the boys get some business *now?*"

What about the prospect who says "We're waiting to see what the course of business is—what the President says—until Congress adjourns—until elections?"

What about the prospect who says—"your price is too high," or "I don't believe those claims" or "we prefer another brand" or "we always used the X product with good results."

You'll conclude that *ignorance* of the truth about your product —how it will help users *meet* the present day problems caused by business conditions or legislation,—is costing your salesmen orders, and costing you volume and profits right now—costing people in your community jobs—costing your stockholders dividends.

Better yet—turn over 100 such sales reports to your advertising agency and ask them whether your appropriation is adequate to overcome the sales resistances you meet today.

Published in the interests of greater sales, employment and profits in 1938 by the McGRAW-HILL PUBLISHING COMPANY, INC., NEW YORK, N.Y.

CONVEYOR SPEED
GALLONS PER MINUTE
BAKING TIME

ALL INDICATED

Electrically

WITH

WESTON TACHOMETERS

Whatever the significant units—r.p.m., gals. per min., ft. per sec., drying time, etc.—electrical indication leads in simplicity, flexibility and accuracy. The magneto is easily installed and quickly wired to the indicator. Indication is exact because the magneto-indicator relation is unvaryingly proportional. Operation is consistently trouble-free, for there are no flexible shafts or other moving parts necessarily subject to wear. If desired, two or more indicators at different locations can be operated from the same magneto. Complete information on request. Weston Electrical Instrument Corporation, 628 Frelinghuysen Avenue, Newark, New Jersey.

WESTON *Instruments*

Industrial Consultants

OLIVER FIELD ALLEN
Licensed Professional Engineer, New York State
Fellow: A.I.E.E. Member: A.S.M.E. S.A.E.
Am. Chem. Soc., Soc. Am. Mil. Engrs.
Consulting Engineer
Diesel Engines, International Engineering Liaison.
Gas and Oil Engine Power Applications.
Regular Foreign Correspondents
117 Liberty Street, New York City
Cable Address: OFALL-New York

METHODS ENGINEERING COUNCIL, INC.
MOTION AND TIME STUDY INDUSTRIAL MANAGEMENT
INSTRUCTION CONSULTATIONS
TRAINING INSTALLATIONS
Wood and Franklin Streets, Station 31
Pittsburgh, Pa.

ALLAN H. MOGENSEN
Training in Work Simplification
330 W. 42nd Street
NEW YORK CITY

INEFFICIENCY

with its resultant waste, plays havoc with production costs.

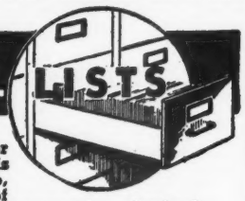
PROFITABLE OPERATION

is dependent upon correct plant design, management, processes, equipment and methods.

ADVICE

available through a CONSULTING ENGINEER is frequently the only necessary means of putting a plant on a more efficient production basis.

McGRAW-HILL
DIRECT MAIL LISTS



As business paper publishers for over fifty years, McGraw-Hill is uniquely equipped to offer complete, authoritative direct mail coverage of Industry's major markets. Extreme accuracy is maintained (guaranteed to 98%) and through careful analysis of markets, complete classification of companies and personnel, etc., the widest possible selections are available. Send for handy reference folder "Hundreds of Thousands of Reasons Why" which describes how McGraw-Hill Lists are built and maintained.

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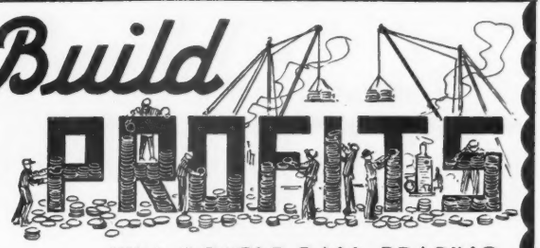
McGRAW-HILL PUBLISHING CO.
330 W. 42nd STREET NEW YORK, N. Y.

. . . Complete lists covering industry's major markets

Build PROFITS



With DOUBLE BALL BEARING
DARNELL
CASTERS & WHEELS

Money saved is money earned...and certainly Darnell products are noted for the savings they make. The easy-swivelling, easy-rolling qualities of Darnell Double-Ball-Bearing Casters save floors and equipment, while the increase in employee efficiency make their use a continued source of satisfaction and profit. Write for new Darnell Caster and Wheel Manual.

Made in both swivel and stationary types with either rubber or semi-steel wheels.

DARNELL CORPORATION, LTD.
BOX 4027-F, STA. B, LONG BEACH, CALIFORNIA
36 N. Clinton St., Chicago • 24 E. 22nd St., New York

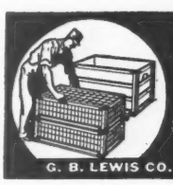
FACTORY MANAGEMENT and MAINTENANCE

Equipment Materials Supplies — *SERVICE SECTION* — *For Plant Mill and Factory*

40 TYPES of MEYLAN STOP WATCHES
A watch for every purpose

Ask for FREE folder No. 9F fully illustrating and describing some 40 types of stop watches. No salesmen will call.
REPAIR SERVICE for all kinds of plain and complicated stop watches
Send for estimates, no charge, no obligation.
A. R. & J. E. MEYLAN
"Specialists in timing instruments"
264-70 W. 40th St. New York

Minerva SINCE 1858
STOP WATCHES
Unrivalled for accuracy plus economy in time study. Newly Patented rust and corrosion proof coil springs retain accuracy, never break. Send for circular. REPAIR SPECIALISTS. ALL MAKES.
M. DUCOMMUN 580 5th Ave., N.Y.C.



30 DAY FREE TRIAL OFFER!
Multitrip
Skid Boxes • Box Trucks
Shipping Boxes
G. B. LEWIS CO., Dept. X, Watertown, Wis

Do You Use Your Own Product?

If so, how many plants represented by the 25,000 readers of *Factory Management and Maintenance* could use it too (and would BUY it) if your advertisement appeared here?

THE PURE OIL COMPANY, U.S.A. — PURE — INDUSTRIAL DEPT. — APPLICATION — THREE — POINT SERVICE — CRUDE

THE PURE
A COMPLETE LINE OF INDUSTRIAL PETROLEUM PRODUCTS
PURE THREE POINT LUBRICATION
OIL CO.
CHICAGO, U.S.A.

SEARCHLIGHT SECTION

EMPLOYMENT : BUSINESS : OPPORTUNITIES : EQUIPMENT—USED or RESALE

UNDISPLAYED RATE:

15 cents a word, minimum $3.00 an insertion.

(See ¶ on Box Numbers)

Positions wanted **(full or part-time salaried employment only), ½ the above rates.**

Proposals, **40 cents a line an insertion.**

INFORMATION:

Box Numbers **in care of our New York, Chicago or San Francisco offices count 10 words additional in undisplayed ads.**

Discount of 10% **if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).**

DISPLAYED—RATE PER INCH:

1 inch $8.00
2 to 3 inches ..... 7.80 an inch
4 to 7 inches ..... 7.60 an inch

An advertising inch **is measured vertically on one column. 3 columns—30 inches—to a page. Contract rates upon request.**

F.M.M.

Copy for new advertisements must be received by September 16th for the October issue

EXECUTIVE—

For sound practicable rehabilitation job or where infusion new blood desirable, aggressive but not high pressure executive who knows selling from having sold, planned profit conscious sales management from handling district offices and salesmen; cost cutting plant operation from long experience as works manager of competitive manufacturing plant; purchasing from having been purchasing agent; costs from looking after them; pay rolls from having met them; creative, resourceful, not afraid to pioneer, but with feet on ground; good judgment; steel mill operation and engineering, hardware and stamping manufacturing, plastics, precious metals, and educational background; age 42; Protestant; family; M.I.T. mechanical engineering graduate; three connections in twenty years; record will stand investigation.

PW-504, Factory Management & Maintenance, 330 West 42d Street, New York City.

SALARIED POSITIONS
$2,500 to $25,000

This thoroughly organized advertising service of 28 years' recognized standing and reputation carries on preliminary negotiations for positions of the caliber indicated, through a procedure individualized to each client's personal requirements. Several weeks are required to negotiate and each individual must finance the moderate cost of his own campaign. Retaining fee protected by a refund provision as stipulated in our agreement. Identity is covered and, if employed, present position protected. If you have actually earned over $2,500, send only name and address for details.

R. W. BIXBY, INC.
276 Delward Bldg., Buffalo, N. Y.

● ANNOUNCING

a new home study course in motion study and work simplification for

FOREMEN AND KEY SUPERVISORS

Prepare for personal advancement by training yourself to improve methods and reduce costs.
Send for free booklet entitled, "THE MODERN FOREMAN."

Methods Engineering Council
Industrial Training Division
Wood and Franklin Streets
Pittsburgh (21) Pennsylvania

POSITIONS WANTED

AGGRESSIVE YOUNG MAN with experience in Cost Accounting, Time Study and Production Control work in machine and textile industries desires to make connection with progressive organization. Good theoretical background in accountancy, 33 years of age, married. PW-505, Factory Management & Maintenance, 520 North Michigan Avenue, Chicago, Illinois.

TIME STUDY ENGINEER, age 27, 5 years experience in motion and time study, plant layout, methods standardization, wage incentives, cost reduction. Have had Installation experience with leading Industrial Engineering Consultant. Wants permanent position, will locate anywhere. PW-506, Factory Management & Maintenance, 330 West 42nd Street, New York City.

INDUSTRIAL ENGINEER—1938 Rensselaer graduate, I.E. degree. Familiar with job and cost analysis, production control methods, and personnel activities. Inexperience supplanted by faculty to learn. PW-507, Factory Management & Maintenance, 520 North Michigan Ave., Chicago, Illinois.

LABOR RELATIONS: Employment, plant protection, 45, successful record, reasonable salary; go anywhere. PW-509, Factory Management & Maintenance, 520 North Michigan Avenue, Chicago, Illinois.

MECHANICAL ENGINEER—25, single, desires place on plant engineering staff. Four years designing experience on special machinery and materials handling. Good foundation in organization containing standard industrial divisions; pattern-making, founding, welding, machining, assembling, etc. PW-510, Factory Management & Maintenance, 520 North Michigan Avenue, Chicago, Illinois.

MANAGEMENT ENGINEER. Technical graduate, also thorough engineering training and experience with large and medium sized concerns for over 20 years. Both electrical and mechanical experience, such as quality engineer covering test, inspection and service, or industrial engineer covering methods, layouts, time analysis, production control, maintenance, etc. PW-511, Factory Management & Maintenance, 520 North Michigan Ave., Chicago, Ill.

EMPLOYMENT SERVICE

IMMEDIATE OPENINGS for Works Managers, Shop Superintendents, Production Managers, Chief Manufacturing and Designing Engineers. Write for application. Established 23 years. Harrison Personnel Service, 20 W. Jackson, Chicago.

AGENT AVAILABLE

MANUFACTURERS AGENT—St. Louis Territory. 10 years experience selling industrials wants profitable commission line. Can furnish showroom, warehouse and delivery service to manufacturer offering attractive proposition. AA-508, Factory Management & Maintenance, 520 North Michigan Avenue, Chicago, Ill.

Manufacturers' Agents and Representatives

A nationally known AaA-1 storage battery manufacturer with a 40-year reputation for building one of the finest and most complete lines of wet storage batteries for industrial purposes, is shortly expanding sales activities in all sections of the country.

A high grade manufacturers' agent organization or representative will be chosen in each sales area to supplement and assist the regular factory sales force. If you have a successful selling record, experience and established contacts in the manufacturing and construction fields, you will be interested in the very sound and profitable proposition that is available on a commission basis.

Complete data, training, and the assistance of an experienced factory man will be available to familiarize you with all features of this great line. If you are qualified, investigate today by giving full particulars on your organization or individual record, in care of RW 502, Factory Management and Maintenance, 520 No. Michigan Ave., Chicago, Ill.

The following territories are available: Boston, Philadelphia, Atlanta, Charlotte or Richmond, Birmingham, Detroit, New Orleans, Kansas City, Dallas, Houston, Minneapolis, Milwaukee, Denver, Salt Lake, San Francisco or Oakland, and Baltimore.

WANTED

Generator for D. C. secondhand or new 6,000 to 8,000 amperes, voltage 14 to 15, **or two D. C. Generators,** secondhand or new, 3,000 to 4,000 amperes, voltage 14 to 15. Offers requested immediately to Box 1011, Bergh Werbe Dienst, 11 Muenchenerstrasse, Berlin W. 30, Germany.

Announcing

the establishment of an office . . . at 307 Fifth Ave., New York City (Suite 1502) . . . for service on the

INSPECTION & APPRAISAL OF MACHINERY

15 years of experience. We serve both Buyer and Seller.

Certified Inspection Reports

Our Certified Inspection Report is your best guarantee for value received.

K. M. KELLER & CO.

-TRANSFORMERS-

A Complete Stock. Prompt Shipment.

SPECIAL **$675.00**

2—350 KVA Moloney Transformers, 3-phase, 60 cycle, 2300–440 V. EACH

We Rewind, Repair and Redesign all Makes and Sizes.
ALL TRANSFORMERS GUARANTEED FOR ONE YEAR
Write for Catalog No. 133-D

THE ELECTRIC SERVICE CO., INC.
"AMERICA'S USED TRANSFORMER CLEARING HOUSE"
SINCE 1912
STATION M CINCINNATI, OHIO

Motors & Generators

Save by buying guaranteed rebuilt equipment from our large stock.

SLIP RING MOTORS

H.P.	Speed	Make	Type
300	514	G. E.	IM–17A
400	600	G. E.	IM
400	514	G. E.	MT–410Y
500	600	West.	CW
500	450	G. E.	MT–412
600	514	West.	CW
700	400	G. E.	MT–432

SYNCHRONOUS MOTORS

75	1800	G. E.	TS
100	720	G. E.	TS
125	900	G. E.	TS
300	720	G. E.	ATI
300	600	G. E.	ATI

MOTOR GENERATOR SETS

1—150KW, 250/275 Volt G.E. Synchronous
1—200KW, 250/275 Volt G.E. Synchronous

Write for a copy of our 24-page Stock List.
Your inquiry will be answered promptly.

Electric Generator & Motor Co.
4519 Hamilton Ave. Cleveland, Ohio
Established 1900

A Tag Marked "SOLD"

on the idle equipment in your plant will make it an asset. Order your advertisement in the next issue.

Address:
Departmental Advertising Staff

ELECTRICAL MACHINERY

Motors and Generators, A.C. and D.C. for sale at Attractive Prices. Large stock. New and Rebuilt. All Guaranteed. *Write for Stock List and Prices.*

V. M. NUSSBAUM & CO.
FORT WAYNE, IND.

New "SEARCHLIGHT" Advertisements

must be received by Sept. 16th to appear in October issue.

Address copy to the Departmental Advertising Staff Factory Management and Maintenance

330 W. 42nd St., New York City

STEEL BUILDINGS

62x400 with indoor craneway.
60x140 without craneway.
130x193 with or without crane.
25 ton O.H. Electric Traveling with 5 ton Aux. Hoist, 60 ft. span, 3-60-220. Other Bldgs. and O.H. Cranes too!

IRON & STEEL PRODUCTS, INC.
Chicago (Hegewisch Sta.) Illinois
"Anything containing IRON or STEEL"

Holding your own as a business executive—

clarified and made easier by these books

THERE is nothing sadder than the cases of star performers in production, in sales, accounting, or other departments of business practice, who fail to take hold when faced with executive duties and opportunities. The problems of analyzing, deciding, planning, and administering involve broad fundamentals that, consciously or otherwise, the successful executive uses every day. And to provide a comprehensive, adequate treatment of these principles, is the purpose of this library.

THE BUSINESS EXECUTIVES' LIBRARY

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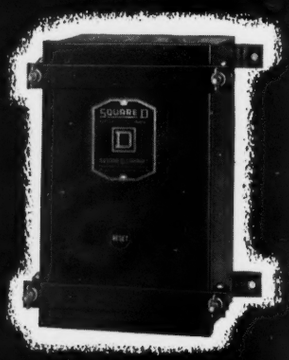

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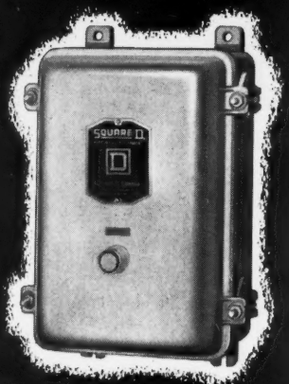

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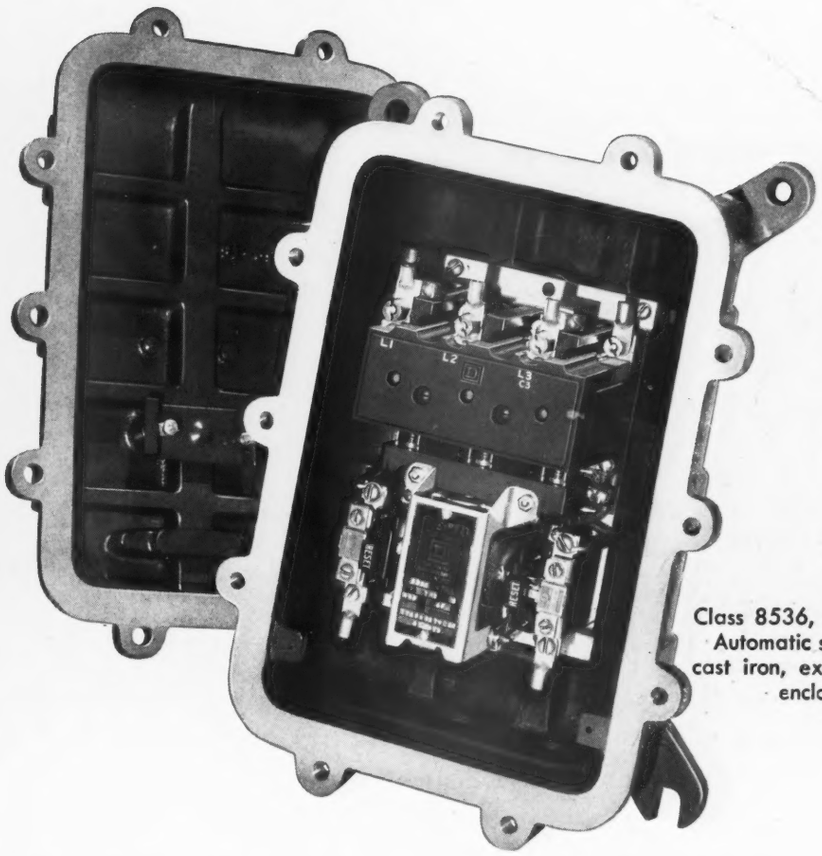

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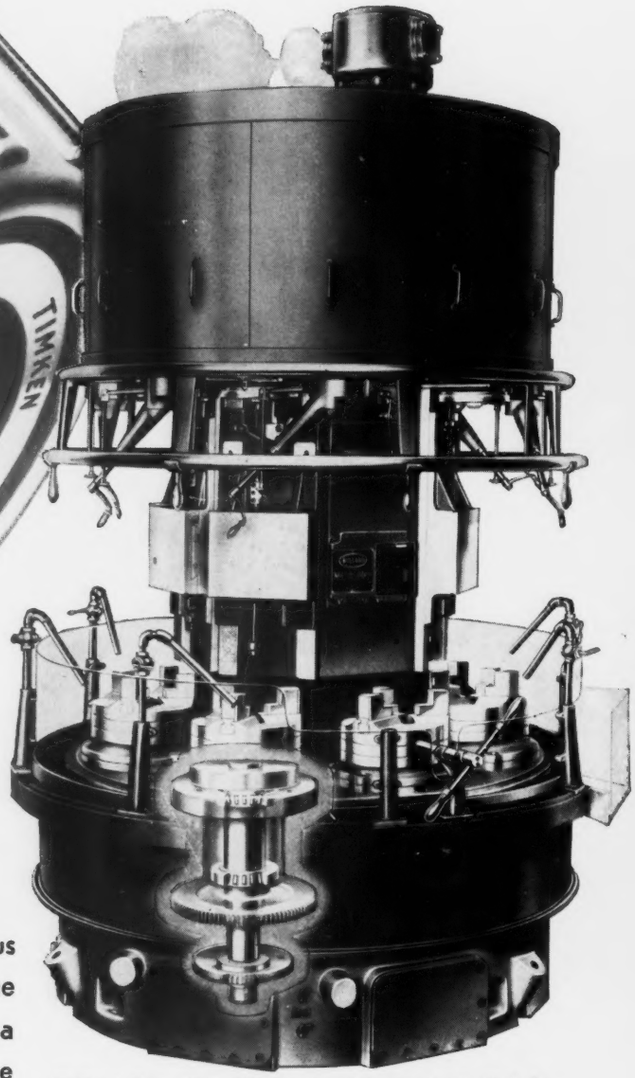

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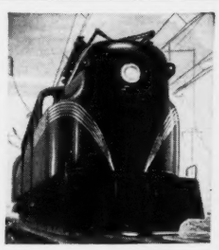

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